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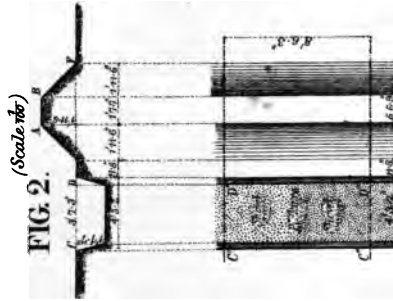
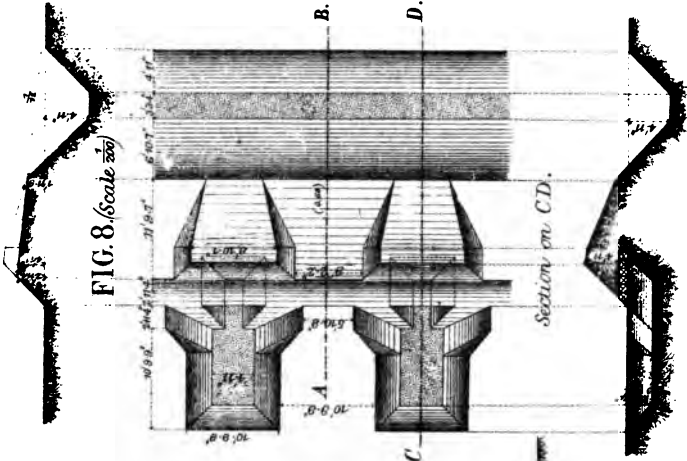
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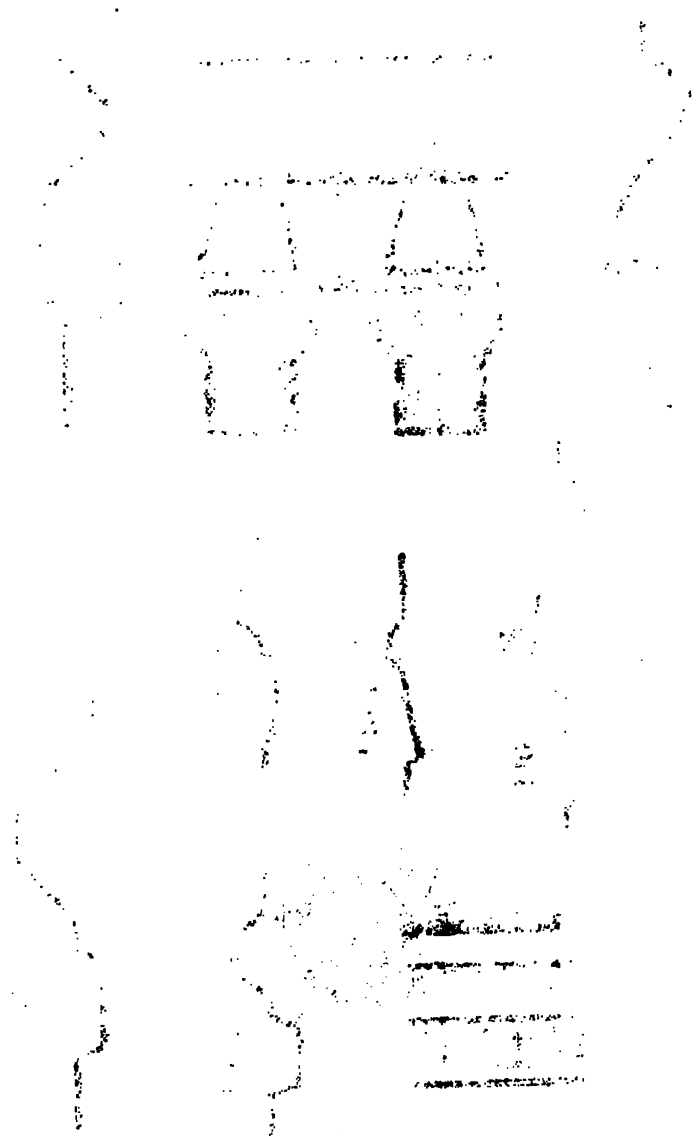
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BY

A. BRIALMONT

COLONEL ON THE BELGIAN STAFF

TRANSLATED BY CHARLES A. EMPSON

LIEUTENANT ROYAL ARTILLERY

WITH NINE PLATES



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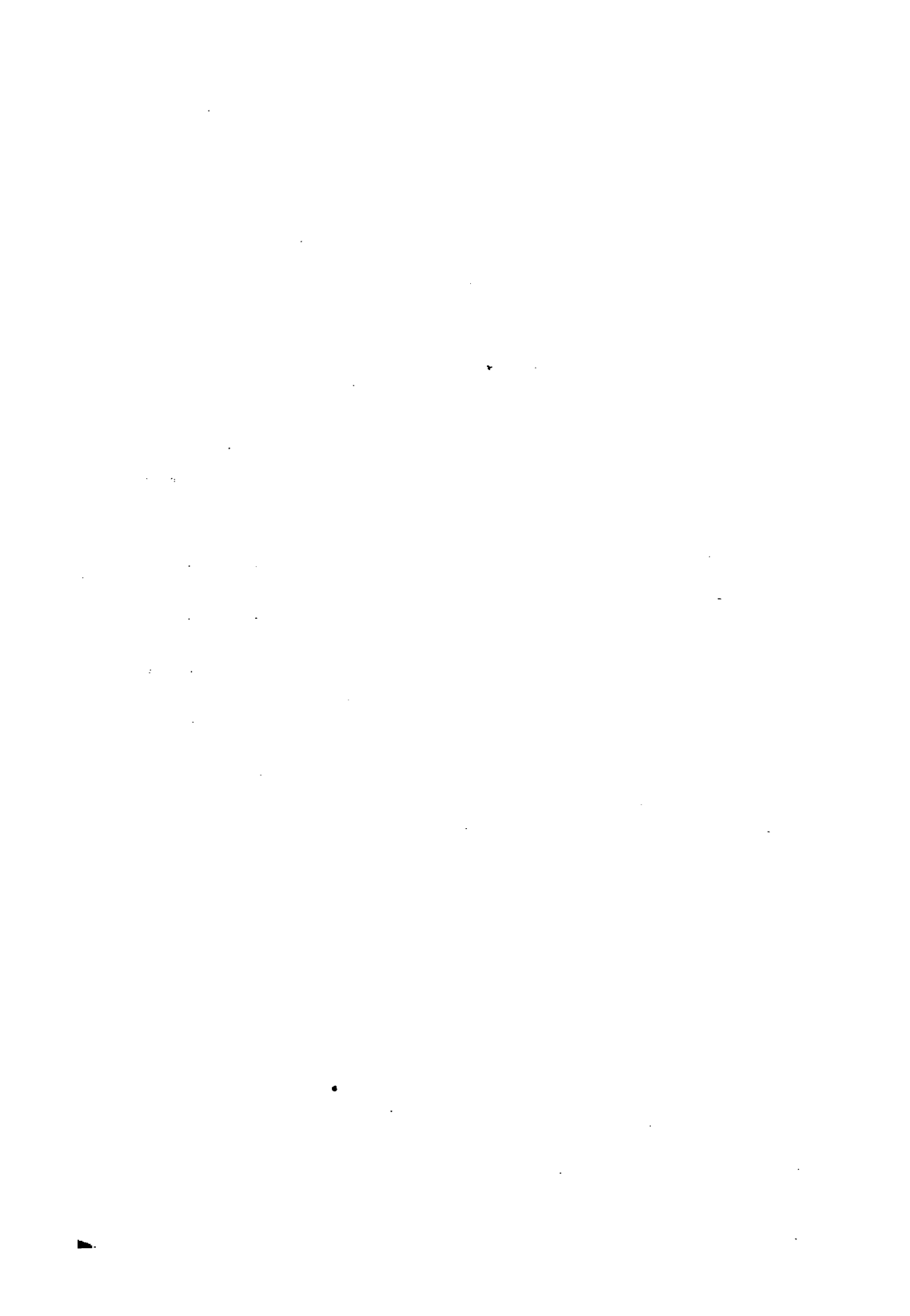
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NOTE.

IN many cases the dimensions given to the different profiles &c. will appear unnecessarily minute ; but in converting the French into English measures, unless the exact figures had been given, the various calculations would not have worked out correctly.

Translator.

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HASTY INTRENCHMENTS.

'Les principes de la fortification de campagne ont besoin d'être améliorés.'

NAPOLÉON.

CHAPTER I.

GENERAL REMARKS.

IN all ages intrenchments have been made use of to fortify the weak parts of camps or of fields of battle, and to shelter the troops from missiles. The Roman legions executed works of this kind, in presence of an enemy, with wonderful skill and rapidity. An historian says of them, 'It was by moving earth that they conquered the world.'

Fortifications on the field of battle have a favourable moral effect on the troops defending them, and an unfavourable one on the attacking forces. They increase the difficulties and the losses of the assailant; and he, being taken unawares, and sometimes not even knowing of their existence at the commencement of the action, cannot form a correct opinion of their importance or take steps in time to avoid or outflank them. On this account hasty intrenchments, formed unknown to the enemy, will often be of greater use than redoubts and forts executed at leisure and with great care.

The first general of modern times who gave much importance to field works was the Emperor Charles V. In 1547, when he found himself in face of the Allied Army, which was twice as strong as his own, but which made the mistake of not attacking

him at once, he made use of the first night to intrench his position, which on the next day was in a state of defence. He continued to work at it for 12 days. On the 13th day the emperor, having received a reinforcement of Dutch troops, took the offensive. Three months afterwards the campaign was brought to a close by the complete dispersion of the enemy's forces.

Charles V. had prepared for this result by attaching to each regiment of Lansquenets¹ a company of 400 pioneers. This company was placed under the command of a special officer, and took with it a small store of tools.

It was a similar organisation which enabled the Prince of Parma in 1584 to carry out the enormous works required for the blockade of the Scheldt and the siege of Antwerp. His Army contained 3,000 pioneers, which were reinforced when necessary by working parties of Infantry.

Since that time troops specially charged with the execution of field works have lost their importance, although these works have still been frequently made use of, as is proved by the wars of the Princes of Nassau, Gustavus Adolphus, Louis XIII., and Louis XIV. ; but during these wars the fortifying of villages and the construction of circumvallations and of frontier lines were the work, either forced or voluntary, of peasants. The troops only took part in it in exceptional cases and to a small extent.² Historians affirm that the soldiers disliked making use of navvies' tools, although their commanders and sovereigns themselves³ made praiseworthy efforts to destroy this prejudice.⁴

¹ German foot soldiers. (Transl.)

² See *Les Mémoires militaires relatifs à la guerre de la succession d'Espagne*. By General De Vault.

³ Louis XIV. went to live at Dunkirk for a month in order to encourage, by his presence, his praise, and his rewards, the 30,000 soldiers who were employed on the works of that place under the orders of Vauban. (See Allent's *Histoire du corps du génie*.)

⁴ This prejudice has long existed in European armies, and still exists in some of them.

General Rogniat said in 1817, 'There is among the French troops an incompre-

Turenne, while condemning the too extensive and purely defensive works to which the war in the Netherlands had given vogue, pronounced in favour of the use of intrenchments which could be rapidly formed, and which were so placed as not to interfere with the offensive movements of Armies. He was in the habit of fortifying his positions by means of redans protected by abatis. These works, which consisted of a kind of trench intended to cover the Infantry of the first line, required only a few hours' labour. The spades, pickaxes, axes, and other tools necessary for their construction were carried on the cruppers of the Dragoons.

At the battle of Poltawa Peter the Great was able to resist the vigorous attacks of the Swedes because he had had the foresight on the night before the battle to construct seven redoubts along the front of his Infantry.

Frederick the Great also had recourse to fortification whenever the fortune of war obliged him to remain on the defensive: for instance, the retrenchments which he had made under the walls of Schweidnitz just as his Army, 60,000 strong, was about to be attacked by 130,000 Austrians and Russians. It was one of his military aphorisms that every commander of a post or detachment should know how to construct intrenchments. He says in his *Mémoires*: 'Officers require different kinds of knowledge, but one of the principal is that of fortification.'

The Austrians and the Russians, at the time of the Seven Years' War, made several successful applications of hasty intrenchments.

In 1757, 20,000 Austrians under the orders of the Count of Königseck had taken up a position at Reichenberg behind a line of redoubts, batteries, and trenches. The Duke of Bevern, having attacked them from his right, was repulsed 'because the left flank of the Prussians was exposed to the fire of the redoubts and to that of the Infantry defending them.' In order

hensible prejudice in favour of idleness which treats the pioneer's tools with contempt.'

to carry the position the Prussian Army was obliged to outflank it and take it in reverse.

The part taken by the intrenchments which the Austrians and Russians (under Laudon and Soltikof) had constructed at Kunersdorf in 1759 was still more remarkable. General Jomini says that the defensive works of the Mühlberg and Spitzberg, situated on the left of the Allies, caused a terrific fight, 'of which it would be impossible to convey an idea.' The Russians defended these points with so much obstinacy that Frederick had to fall back after unparalleled efforts, leaving on the ground 165 guns, besides 20,000 killed and wounded, that is to say, half his strength.

Towards the end of the eighteenth century, in 1792, we find that the Austrians commanded by Duke Albert constructed in front of their position at Jemmapes 14 redoubts armed with 36 heavy guns. These works enabled 20,000 Imperialists to make an honourable defence against 50,000 Republicans, and then to retreat in good order, leaving on the battle-field only 2,000 killed and wounded.

Archduke Charles appreciated the advantages of extemporised defences¹ as much as Frederick II., but, with the exception of the above instances, the Austrian Army had long since discarded the judicious practices of Charles V. It is this which accounts for the Archduke's so seldom making use of intrenchments. His campaigns offer scarcely more than one instance of them, viz. that of Caldiero, where his Army, covered by redoubts, intrenched buildings and lines of abatis, stopped for three days Masséna's troops, who were endeavouring to force their way towards the Danube.

¹ He says that the action of intrenchments is both moral and physical. They oppose a barrier to the enterprise of the enemy, and protect their defenders from his fire; they bind inexperienced officers to the most important posts, and leave them no doubt as to the employment of troops and guns. But, like every instrument, they lose their value when a bad use is made of them, that is, when they are constructed aimlessly, unskillfully, and without being bravely defended. (Quotation taken from an Austrian military journal.)

An Austrian military writer reproaches the Archduke for not having done more. He says, 'After the battle of Aspern, during the 6 weeks' truce, decisive tactical points might have been formed by fortifying Aspern, Esslingen, Neusiedeln, Wagram, &c., and from that time out the campaign of 1809 might have had an altogether different termination.'¹

Under the French Republic General Jourdan successfully employed extemporised intrenchments at Fleurus in 1794. These intrenchments were composed of lunettes, flèches, and trenches, covering the villages of Lambusart and Heppignies, besides a large redoubt, armed with 18 guns, covering the plain to the right of the latter village.

Napoleon was able to prove the utility of intrenchments and fortified posts under a large number of circumstances. A simple redoubt, constructed on the road of Montenotte, and defended by Colonel Rampon, resisted three assaults of the Austrians. M. Thiers says, 'It saved the general's plans, and perhaps the future of the campaign.'

At Aspern some intrenchments and two imperfectly fortified villages preserved his Army from complete defeat.

At Dresden the redoubts constructed in the plain and the stockades which surrounded the suburbs contributed largely to the victory which the French Army gained over the Allies on August 26, 1813.

During the battle of Wachau, fought on October 16 under the walls of Leipzig, a simple redoubt, called the Swedish redoubt, held in check one of the divisions of the French left wing; Napoleon had to reduce it at whatever cost in order to

¹ *Oestreichische Militär-Zeitschrift*, 1865.

For some years past ideas in Austria as to the utility of intrenchments have undergone considerable modification. A military writer of that country affirms that it is now generally admitted, 1st, that an intrenchment occupied by 200 men offers as much resistance as a battalion in open country, and 2nd, that the work done by 1,000 men in five or six hours, in a position occupied by a mixed division, is equivalent to its reinforcement by a brigade.—*Oest.-Mil. Zeit.* Sept. 1868.

render possible the offensive movement of Macdonald against the right of the Allies.

At the commencement of this same campaign of 1813 the Emperor had had important intrenchments constructed in Saxony, between Pirna, Gieshübel, and Dohna.¹ Independently of the redoubts which defended the table-lands of Pirna and Gieshübel towards the outer side, there was the intrenched castle of Sonnenstein at the end of the former and the fortified heights of Kohlberg at the end of the latter, forming a second line of defence.

We may, then, affirm that Napoleon was a decided partisan of hasty intrenchments. He used to complain, while at St. Helena, that more frequent use had not been made of them during his reign.

‘Those,’ said he, ‘who proscribe the help which the engineer’s art may afford in the field deprive themselves voluntarily of an auxiliary force and expedient which are never hurtful, always useful, and often indispensable.’

‘The assertion that victory is for him who marches, advances, and manœuvres, and that work is unnecessary, appears plausible, but is at the same time a mistaken one.’

The Duke of Wellington constructed intrenchments and fortified posts at Talavera, Fuentes Onoro, and Waterloo, but in this respect he may be reproached, like Prince Charles and Napoleon, with not having done enough.

Marshal Soult, being obliged to fall back before the English Army in the Peninsula in October 1812, had several lines of intrenchments (composed of redoubts, batteries, and abatis) constructed to dispute the passage of the Bidassoa and the Nivelle, from Urugne to Espelette, on a front of $4\frac{1}{2}$ leagues (about 11 miles).

At Toulouse he protected the front of his Army (which was

¹ Seven divisions defended these positions, by which the enemy must necessarily debouch; unfortunately for the French Army the Allies began their offensive movements before the fortifications were completed.

placed on Mont Rave) by means of seven redoubts, in the intervals between which were intrenched houses and abatis. These works caused the English to suffer great loss, and enabled the Duke of Dalmatia to effect his retreat in good order.

Since 1815 several generals have had recourse to hasty intrenchments, and they have all found them useful.

The victory of the Austrians before Verona was owing in a great measure to the defensive works which Radetzky had had thrown up round the village of Santa-Lucia.

Vallegio, which was quickly fortified in 1848, rendered the greatest service to the Imperialists during the battle of Custozza. This village, on which their right wing rested, was, in fact, unsuccessfully attacked twice by General Bava, who finished by retreating.

It is worthy of remark that, in the disastrous campaign of 1859, the Austrians made no use of hasty intrenchments. The French, better instructed, intrenched Vercelli to support their offensive march; and fortified Palestro, as well as the tête de pont of Turbigo, to ensure their retreat in case of reverses.

During the campaign of 1866, Benedek's Army constructed at several points epaulments for the batteries, intrenchments for the supports, and cover for the skirmishers. It is allowed that these works rendered them great assistance.

But never have hasty intrenchments been used with greater success, or more generally, than in the last war in America.

It was to some extent an instinctive feeling which led the soldiers of the United States to throw up intrenchments wherever the armies halted.

'They waited neither for orders, nor deployment of skirmishers, nor formation of lines. The work was not carried out by an isolated brigade or division, but by all the brigades and all the divisions, each working on its own account. The rule was that the troops should proceed with this work without waiting for orders. When a column halted after a long day of marching or fighting, before it concerned itself with getting

fires, cooking provisions, or any other of the occupations of camp life, it set to work to intrench itself, and the rapidity with which this work was completed is unequalled.

‘Whether they were in woods, on a hill, in a valley, or in a corn-field, the soldiers began by intrenching; then, settled down behind the cover they had erected, they took their coffee, or prepared their dinner, and afterwards rested in safety.

‘At daybreak these intrenchments were abandoned, and the army renewed its march.’

‘In his report on the Atalanta campaign, General Sherman repeatedly remarks on the importance of these intrenchments, and the incredible facility with which the troops constructed them. “At New Hope Church,” he says, “the enemy was repulsed, but having hastily thrown up some intrenchments, he maintained his position, and on the following day we found him strongly intrenched, and our attack was fruitless.”

‘At Dallas the enemy made an impetuous attack; luckily our men had established good intrenchments, which enabled them to give the assailants a sanguinary check.

‘We read in the same General’s report on the great battle of July 28: “Towards ten o’clock, when the army was in position, the men improvised serviceable intrenchments with the help of piles of rails and sleepers. The skill they showed was really astonishing; for want of spades they used bayonets, knives, cans, bowls—in one word, anything that came to hand.”’¹

Often the men began by *earthing* themselves, that is to say, by digging holes which they subsequently joined together to form intrenchments.

It was almost in this way that the Russians constructed their ambuscades during the memorable siege of Sebastopol.

General Niel says:—‘These ambuscades, which played such a prominent part, generally consisted of a hole, at the outside a mètre (3¼ feet) deep, the earth from which, being thrown up on

¹ *Army and Navy Journal*, 1868.

the side to be attacked, formed a small parapet surmounted by a battlement of sand-bags. A rifleman crouching behind it was well covered from Infantry fire, and his shelter offered very little mark to that of Artillery. The most advanced of these little posts were supported by others nearer the town; if they were attacked, the riflemen in the front row retired to the more distant ambuscades, and if the besiegers advanced in force to destroy this shelter, all the riflemen retired into the ditch at a pre-concerted signal, so as to leave the assailants exposed to the fire of the place. The Russian Engineers, favoured by the inequalities of the ground and by the great superiority of their Artillery fire, turned this kind of defence very skilfully to account. But if a soldier in one of the little ambuscades was wounded during the day, he had to wait a long time without help under the eyes of his comrades in rear. It appears that to this drawback must be attributed the development subsequently attained by these posts, which ended by being joined to one another.'

General Barnard, of the United States Engineers, has published some interesting remarks on the part played by hasty intrenchments during the War of Secession.¹

'If,' said he, 'the defensive works of Richmond or Petersburg are examined, a fact will be apparent which is very important, and which is, besides, confirmed by the whole war; that is, that a simple trench defended by two ranks of Infantry constitutes, under certain easily fulfilled conditions, an obstacle which is almost unassailable by main force.

'This truth, demonstrated at Bunker's Hill and New Orleans, has received a striking confirmation since the introduction of rifled breech-loading arms; it is known at the present day what sacrifices are necessary to carry a line of riflemen formed in two ranks, or even in one, and sheltered by an intrenchment, the approaches of which are defended by Artillery. We give below

¹ *A Report on the Defences of Washington.* Washington, 1871.

an example taken from the interesting report of General Wright, who commanded the 6th Corps at the attack of Richmond and Petersburg.

‘He writes as follows : On March 25, an attack was directed by the insurgent forces against the right of our line, which was defended by the 6th Corps. This attack was repulsed. Convinced that the concentration of the enemy’s troops for this attempt must have considerably weakened their line at other points, I at once directed our efforts, in concert with General Humphreys, who was commanding the 2nd Corps, against the intrenched line of the enemy’s advanced posts, which was 600 or 700 yards in front of the principal line of defence. We took possession of the line of advanced posts after a desperate encounter. I hastened to have such works executed as were necessary to enable me to defend it by turning its front against the rebels, and I maintained the conquered position in spite of all their efforts to dislodge me.

‘The line referred to consisted of a continuous trench with a parapet, which afforded efficient shelter for the defenders ; in a word, it was an uninterrupted succession of field works, which were wanting only in the accessory means of defence usually employed in such cases, such as abatis, fraises, &c. ; these had indeed existed at first, but the want of fuel had caused their removal, by general consent, by the advanced troops of the two camps. There remained then, as we have said before, simply a parapet capable of giving cover to Infantry, but without any external obstacle.

‘An idea of the value of such an intrenchment may be formed from this fact, that, defended as it was by a single line of Infantry, we could not make ourselves masters of it without a loss of several hundred men. It is only fair to say that the rebels’ resistance was obstinate, that they did not retreat, and that all their skirmishers were killed or taken prisoners. But it is no less true that we had two divisions opposed to a handful of Infantry deployed in single rank, and that the number of our

killed exceeded the total effective strength of the enemy. If the intrenchment had been defended by two ranks of good troops, it is probable that the entire Corps d'Armée would not have been able to take it.

'The line of intrenchment as described above was 600 or 700 yards from the enemy's front ; the ground before it had a gentle slope, and was such as to be very advantageous for the assembling of troops.

'The extension of our lines in the direction of Five-Forks, which was made in the last few days of March and on April 1, produced a corresponding extension of those of the enemy, and a decided reduction of his numbers at every point. We consequently considered the time favourable for an assault. The enemy's principal line of defence, as seen from the position we were occupying, had the appearance of a continuous parapet with a ditch, supported at intervals by flanking batteries, and covered by a row of abatis. These obstacles seemed to us easy to overcome. Nearly our whole strength, about 1,500 men, was massed during the night in rear of the intrenched line we had conquered before, and this operation was so carefully carried out that the enemy's advanced posts had no suspicion of our movements. We had indeed reckoned, in our plan of attack, on being able to assemble our troops in this way secretly, and on being able to cross the space which separated us from the line of abatis before the enemy could offer any resistance ; in other words, success must depend in a great measure on our adversaries being taken by surprise. On this point the result justified our expectations. Our soldiers carried the line of the enemy's riflemen, and reached, without suffering any loss, the obstacles in front of the ditch ; only we then discovered that these obstacles consisted of two rows of excellent abatis with fraises between them. Our pioneers required about fifteen minutes to open a passage for us, and in that time we lost 1,100 men. We then carried the parapet, and found that it was defended by less than one rank of Infantry.

‘What conclusion must we draw from this remarkable example? Every condition is in our favour; we have at our disposal an enormous force in comparison to the enemy’s; we succeed in assembling it secretly at 600 yards from him, and we arrive in front of his ditch before he can think of resistance; we are favoured besides by a thick mist which almost nullifies the action of his Artillery; and we gain our object, only with immense loss, and only because the effective strength of the enemy is less, by more than half, than the minimum considered necessary for the defence of a field profile. The conclusion to be drawn from this attack is, then, that a simple trench, defended by two ranks of Infantry, covered by abatis or other obstacles, and placed on ground which enables the range of modern arms to be profited by, is absolutely impregnable except by surprise. Such is my conviction, based not only on the particular example I have just cited, but on the whole experience of our war. I am persuaded that the majority of officers share my opinion in this respect. And I have no hesitation in affirming that in the case in question the attack would have altogether failed if the enemy had had the number of troops necessary to man his line of fire.’

After the War of Secession, Generals Schofield and Beauregard proceeded to Paris, where they had several interviews with the Emperor of the French. He, having a deep conviction of the utility of hasty intrenchments, ordered a trial of them to be made at the camp of Châlons, where the troops were at that time (1865) under the orders of Marshal MacMahon.

In less than four hours, 2,000 men, in reliefs of two hours, constructed a shelter-trench 3,000 mètres (3,280 yards) long, with a ditch in front, as shown in Plate 1, Fig. 1. At several points of this intrenchment were constructed barbette batteries, provided with little trenches (*rigoles*) to shelter the detachments.

Some time after that, during some manœuvres on a large scale carried out at Vincennes, a division of Infantry received orders to intrench itself as if it were in presence of the enemy.

The operation was protected by a line of skirmishers. About a third of the numbers in each battalion received tools. In less than half-an-hour the whole division was under shelter in suitably constructed trenches. This experiment was considered 'very conclusive.'

In the 'Observations sur l'instruction sommaire pour les combats,' published by the French Minister of War in 1867, the utility of shelter-trenches is recognized in the following words:—

'The battalions of the first line, deployed and covered, if possible, by ridges of earth, trenches or other shelter, wait till the enemy has arrived within good range to annihilate him by volley-firing, especially at the time when the attacking columns are forming, and when these columns are advancing towards the position.

'The line should always be ready to re-form columns with rapidity, in order to resist cavalry, to profit by a failure of the enemy, or to seize a favourable opportunity for taking the offensive. It must not be forgotten that the best means of defending a position is often to attack oneself, only limiting the movement if one is not able to decidedly take the offensive.

'To approach unbroken Infantry from the front, in open ground, especially if they are protected by obstacles or by cover, has always been a dangerous operation; at the present day especially, with the new arms, the defence has the advantage.

'Troops having to cross 300 or 400 mètres, under an overwhelming fire, however brave they may be, would run the risk of being destroyed before having reached the decisive point of the action, and in any case they would arrive too much weakened to fight successfully against an enemy prepared to receive them, and who would take the offensive at the last moment.'

The war of 1870-71 has confirmed this opinion. Indeed the following may be read in the 'Rapport sur les opérations du 2e Corps,' by General Frossard (page 115).

'If the losses of the 2nd Corps at the battle of Gravelotte

were comparatively inconsiderable, we owed this no doubt to the precautions taken to shelter our soldiers by mounds of earth and by epaulments at important points, and we owed it also to the instructions that every hollow or excavation of the ground should be profited by, not for the purpose of keeping the troops lying on the ground there, and letting them remain inactive under cover, but so as to protect them while making them keep up their fire. We have not yet seen so marked an example of the advantages gained by this arrangement of hasty intrenchments. We commend it to the attention of those who will hold commands in years to come.'

CHAPTER II.

SHELTER-TRENCHES.

THE wars of 1866 and 1870 have furnished a new argument in favour of hasty intrenchments, by proving how formidable musketry has become in consequence of the progress it has made as regards range, accuracy, flatness of trajectory, and rapidity of fire.

It is, then, more than ever necessary to bear in mind this precept of Marshal Bugeaud's :—' If the time for fighting has not arrived, keep out of range or else conceal your troops.'

As the difficulty of keeping troops beyond the range of projectiles increases every day, the necessity of concealing them becomes more and more evident. Now to conceal troops, either natural cover (such as ridges of earth, woods, enclosures, deep roads, &c.) must be utilised, or else artificial shelter must be constructed. When the ground is undulating or woody, the troops may easily be shielded from the enemy's sight and fire, but it is quite different when the ground is flat and bare. The necessity too of giving tools for digging to Infantry exists principally in armies operating in level and unwooded countries. In this respect the Swiss, Italian, and Spanish troops are differently circumstanced from those of Germany, Holland, Denmark, and Belgium.

' Shelter-trenches,' says Captain Richard¹ of the Engineers, ' have for their chief object to protect the troops from Infantry

¹ *Des abris à improviser avant le combat.* By M. Joachim Richard. This treatise was published in the number of the *Revue militaire française* for February 1869.

fire, while still offering but a small mark for Artillery. They may also ensure the following additional advantages:—

‘1st. To render the enemy’s fire less certain, as he can only with difficulty see the losses occasioned by it.

‘2nd. To permit our soldiers, placed in a comparatively safe position, to have a rest at a suitable height for their weapons, and consequently to take careful aim without hurrying. Aiming in this way, which must be encouraged not only on account of its efficiency, but also on account of the small amount of ammunition it requires, cannot be arrived at with any certainty on ground which affords no cover.’

It has lately been proposed to use the knapsack to cover the riflemen when they are lying down to fire; but we have strong reasons for thinking that this proposition will not be adopted.

In fact the knapsack is pierced by a rifle-bullet even when it is quite full, which is not always the case in war. Experiments carried out at Ghent in 1869 by Captain Charin prove that, in order to render the knapsack impenetrable by bullets, the back of it ought to be served with tow, and strengthened by iron wire-work weighing about 750 grammes (1 lb. 10 oz.)

This weight is as much as that of the steel shovel, with short handle, adopted in the Danish Army, which would certainly be of more use to the foot-soldier than the knapsack converted into a bullet-proof. In fact, in less than a minute the rifleman would form a mound of earth which would offer greater resistance to projectiles than the knapsack placed at an angle on the ground, or propped up by the bayonet.

On the other hand, a soldier will never be induced to expose to certain destruction part of his clothing, his shoes, his linen, his reserve ammunition, and every necessary contained by his knapsack. Besides, in order to make good this enormous consumption of property, regiments would require to be followed by numerous baggage-waggons, which would obstruct the line of march and impede operations.

Lastly, under many circumstances it would be imprudent to

make the troops take off their knapsacks in presence of the enemy; for example, when they are threatened with an immediate attack or when they are about to advance, for in both cases the men might be separated from their belongings, and prevented from regaining them.

Napoleon said, 'There are five things from which the soldier must never be separated: his gun, his ammunition, his knapsack, his rations for 4 days, and an intrenching tool.'

We must add that the use of the knapsack as bullet-proof would conduce to the immobility of the rifleman, which would be a serious evil.

In order effectually to protect Infantry, there is but one plan, that is, to throw up the earth with tools carried by the troops.

The rifle-pits constructed by the Americans were like unfinished parallels. A large number of riflemen were sheltered in them,—often entire battalions, besides Artillery.

The shelter-trenches constructed in France admit of the same end being attained with more method and in less time. They are the result of individual labour organised and perfected.

The profile of shelter-trenches should be constructed in such a way that the covering mass does not hinder offensive operations. This condition is of the greatest importance, for if defensive works had the effect of keeping one's troops stationary, or of confining them too much in one spot, they would have to be given up, since nothing is more dangerous or more opposed to the spirit of modern tactics.

To arrange shelter with a view to offensive movements is, then, the first problem to be solved.

The approaches constructed before besieged fortresses do not comply with this condition. The same must be said of the hasty intrenchments (see Pl. 1, Fig. 1) constructed in France for some years past by the Engineers, which are composed of a mound of earth, about 3 ft. 3 in. high and 9 ft. 10 in. wide at the bottom, formed out of two cuttings.

This intrenchment, which sappers construct in 35 or 40

minutes, is difficult to cross, and its construction takes too long when Infantry are detailed for it.

The profile recommended by a French memorandum, dated April 19, 1868, is much more suitable (see Pl. 1, Fig. 2). The excavation is large enough to hold two ranks of riflemen, and the mound of earth is thick enough to resist musketry fire. In fact, rifle bullets only penetrate, in freshly dug earth, 11·4 inches at 220 yds., and 16·5 inches at 55 yds., and 19·6 inches at 27 yds.

The total height of the covering mass (3' 7·3") allows of two ranks firing without difficulty. The bottom of the trench serves as a banquette. If the top of the covering mass be 2 ft. above the bottom it forms sufficient shelter from fire for a soldier kneeling.

When the trench is finished, the man firing on his knees and those seated on the berm or on the opposite side of the trench have nothing to fear from musketry,¹ and are almost entirely sheltered from grape. When standing, the riflemen are safe against two-thirds of the bullets which would hit them in the open.

The berm forms a step in crossing; it keeps up the earth, which without it would roll to the bottom of the trench, and it allows of the interior slope *D*, which should be as steep as possible in order to decrease the distance of the riflemen from the interior crest *A*, being cut almost perpendicularly.

Along the open parts of the first line of battle as many shelter-trenches are formed as there are battalions, and they are kept 30 paces apart, so that troops of all arms may be enabled to advance.

The French shelter-trench is the one which offers most advantages with the least amount of work. If not more than 20 or 30 minutes are available, no other kind must be constructed;

¹ We shall see further on that this statement of French authors is not strictly correct.

should it be otherwise, some modifications may with advantage be introduced.

French authors state that a soldier seated on the berm has nothing to fear from musketry. This assertion is incorrect. The fact is, that the conclusion arrived at from a series of experiments carried on at Antwerp in 1871 by the Engineers is that the head of a man sitting on the berm is nearly 8 inches above the top of the covering mass, and that even when he rests his elbows on his knees and his head on his hands the upper part of his knapsack is seen from a distance.

It is impossible to correct this defect without creating another. Raising the height of the covering mass would increase the labour, and would have the effect of obstructing the fire of the rear rank, and of making it more difficult to take the offensive. This latter drawback would also occur if the level of the berm were lowered by 8 inches, which, however, is preferable to the other method, and soldiers will instinctively have recourse to it when they are obliged to remain seated in trenches exposed to projectiles. As this will often be the case in warfare, and as the parapet of the French shelter-trench is only 19'6 inches wide at the crest, we think that it will be advantageous to introduce the following modifications in it, viz. increase the height of the parapet to 2' 7½", and its thickness to 2' 11'4", and, to compensate for this enlargement of the embankment ($\frac{7}{10}$ of a cubic yard for every yard in length), increase the width of the trench by 4' 7".

We have convinced ourselves that a soldier clears without difficulty a covering mass, 2' 7½" in height, of newly dug earth, and that firing is still effectual from over a slope 4' 3" high. This might besides be facilitated by digging the bottom of the trench with a slope upwards towards the parapet, or by giving a depth of a foot only to the part occupied by the rear rank and the supernumeraries.

The widening of the trench satisfies a requirement which has already been several times pointed out, especially in the Pro-

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The widening of the trench satisfies a requirement which has already been several times pointed out, especially in the Pro-

ceedings of the Antwerp Commission of 1871. This Commission expresses itself as follows:—‘The width of the French trench is sufficient for massing two ranks of soldiers and one of supernumeraries, but in such a way that the surveillance which the latter should exercise must be given up, and that no movement on the part of the men is possible; so that they consequently could not conveniently handle their arms for loading and firing.’

It was, however, found in these same experiments that the want of width in the French trenches is no longer a disadvantage when the men in the front rank sit on the berm, resting the left thigh on it, and make their shot by placing their weapon on the superior slope, which gives rise to no inconvenience at all. Then the rear rank and supernumeraries have as much space as they require; but on the other hand, in order to fire in this way, the riflemen must be placed farther apart, so that on the whole the widening of the French trench is as desirable as the thickening of its parapet, which is too weak to resist pieces of shell and bullets fired from short distances.

Captain Richard explains in the following words the method of constructing, and the means of throwing up the French shelter-trench (Pl. I, Fig. 2):—

‘Two companies of the battalion, furnished with tools, in the proportion of two shovels to one pickaxe, are formed in one rank, three paces in rear of the tracing of the line *D*.¹ The men of the working-party place their rifles and knapsacks behind them, and those who have shovels lay them down lengthways on the tracing. Under the superintendence of the officers and non-commissioned officers of the two companies squads are formed, each consisting of two men with shovels and one with pickaxe. Each squad, formed up as in *C' D' D'' C'*, begins work

¹ The tracing is made as follows: An officer from each battalion, assisted by a non-commissioned officer, places as markers, on the edge of the excavation towards the enemy, some sappers, trumpeters, or drummers, about 40 mètres (43 $\frac{3}{4}$ yds.) apart. Then with a pickaxe a line must be cut from one marker to the other. Another line traced in the same way, 4' 3" from the first, marks the inner edge of the trench.

without orders, and will have to dig, to a depth of about $1'7\frac{1}{2}''$, a ditch of the length of two shovels placed end to end, and of a width at the top equal to the length of one shovel, that is, a ditch $8'6''$ long, by $4'3''$ wide.

'The officers and non-commissioned officers of the two companies must point out to the workmen exactly the excavation to be made, the mound to be thrown up, the berm to be left, &c. They will at first have the earth thrown in such a way as to increase at once the thickness and the height of the shelter, so that, even before it is finished, it may be of use in case of a sudden attack.

'Supposing the soil to be *moderate*, increasing one-tenth, and having a natural slope of 45° , each workman will have to dig $1'7\frac{1}{2}'' \times 3'11\frac{1}{4}'' \times 8'6''$ = rather more than 18 cubic feet of solid

3

earth, and to throw up in front of himself, in less than one relief, about $18 + \frac{18}{10}$ = nearly 20 cubic feet of loose earth.

'The work can then be finished in about twenty minutes, if it be admitted that fifty-three cubic feet of earth can be dug and cleared away in an hour by a man who works only for a short period. Although but little used to earth-works, Infantry soldiers who do not work long enough to get tired will attain this rapidity of execution, for it will be to their interest to get quickly under cover.¹

'The shelter formed by two companies will extend to the same length as the front of a battalion of six companies, for two squads or six workmen will throw up a length of seventeen feet, which is almost the space occupied by a front of nine files or eighteen men (each file occupying in the ranks about twenty-three inches). Thus a battalion of six companies may be sheltered in twenty minutes by the work of only two of its companies, or, to speak more generally, the third of the effective

¹ We shall see further on that under ordinary conditions an Infantry soldier clears away only 18 cubic feet of earth per hour.

strength of a body of Infantry can throw up in twenty minutes a shelter-trench for the whole.

'The ease with which the 1866 pattern rifle can be loaded and fired in all three positions—standing, kneeling, and lying down—can be turned to account behind artificial cover.

'Fig. 2, Pl. 1, represents a profile suitable for a man firing standing. This profile, when unfinished and only about 2' 1½'' high, as shown in Fig. 3, Pl. 1, sufficiently protects men firing kneeling in the trench. This position is the one which would as a rule be taken by the two ranks of a body of men surprised by a sudden attack of the enemy before the completion of the profile of the shelter-trenches.

'Lastly, if time or tools be wanting, or if it be wished to shelter the skirmishers in advance of a line of battle, or of the stationary riflemen, a rifle-pit may be hastily thrown up, of a profile similar to Fig. 4, Pl. 1, calculated to protect a man lying down to fire. In a few minutes he can in this way render himself almost entirely safe from the enemy's fire, and at the same time aim correctly, using as a rest either both his elbows or his left one only.'

In front of the rifle-pit, branches should be planted to hide it from the enemy.

The profiles shown in Figs. 3 and 4, Pl. 1, can easily be transformed into those of shelter-trenches, as shown by the dotted lines.

The shelter-trenches shown in Fig. 2, Pl. 1, were constructed in the French camps in twenty-five minutes in ordinary ground, and in thirty-five minutes when it was very hard and sowed with lucerne, the roots of which were a great obstacle to the digging (Camp at St. Maur, 1868).

The Italian Army, in July 1868, at the Camp at Fojano, made shelter-trenches with undrilled troops, and obtained the following results¹ :—

150 men of the 26th Regiment of the line, 100 of whom were

¹ *Rivista militare*, August 1869.

provided with shovels and fifty with pickaxes, constructed in twenty-five minutes a trench 102 yards long, in a clayey field. The distribution of tools took ten minutes.

The dimensions of the trench were as follows :—

| | | | |
|-------------------------|------------------------------|---|-------------------------|
| Length | 305' | } | about 1,470 cubic feet. |
| Depth | $12\frac{1}{2}''$ | | |
| Average width | $\frac{4' 11'' + 4' 3''}{2}$ | | |

Whence it follows that every squad of three men had dug on an average

$$\frac{1470}{50} = 29.4 \text{ cubic feet.}$$

The covering mass was 6 feet wide at the bottom, and nearly 2 feet high.

This result is only half as good ¹ as that obtained at the Camp of Châlons, probably on account of the difference in the soil.

Another experiment was made by the 25th Regiment of the line. 80 men with shovels and 48 with pickaxes constructed in thirty minutes a trench 109 yards long, in cultivated ground composed of clayey sand.

The trench had the following dimensions :—

| | | | |
|-------------------------|-------------------------------|---|-------------------------|
| Length | 328' | } | about 3,080 cubic feet. |
| Depth | $25\frac{1}{2}''$ | | |
| Average width | $\frac{4' 11'' + 3' 11''}{2}$ | | |

The covering mass was 9 feet wide at the bottom and $2\frac{1}{2}$ feet high.

In both cases the parapet was separated from the ditch by a berm.

The profile in Fig. 5, Pl. 1, is that of the intrenchments constructed by the Austrians at Chlum-Nedelist, in July 1866. It allows of two ranks of riflemen being placed under cover.

Colonel Baron de Pidoll recommends the profile in Fig. 6,

¹ At Châlons each man cleared away 53 cubic feet per hour, and at the Camp of Fojano only about 24 cubic feet.

Pl. 1, for works to be executed quickly, and that in Fig. 7, for cover for skirmishers.

By placing the workmen in two ranks and a mètre ($3\frac{1}{4}$ feet) apart, four at most can be employed per lineal mètre for the profile in Fig. 5, and two for those in Figs. 6 and 7.

The profile in Fig. 5 requires an excavation of 141 cubic feet for each mètre of length, that in Fig. 6 of 106 cubic feet, and that in Fig. 7 of 65 cubic feet.

In Austria it is admitted that an Infantry soldier working for twelve consecutive hours without being relieved clears away $6\frac{1}{2}$ cubic feet of ordinary earth per hour.¹ When the men are relieved, the clearing away per hour is nearly 10 cubic feet.

However, some field works executed by 6,000 military workmen, under the direction of Colonel Baron de Pidoll, have furnished a proof that a soldier, working without interruption for a whole day, excavates 15.3 cubic feet per hour.²

According to these figures the construction of the profile in Fig. 5 would require 4 hours 48 minutes; that in Fig. 6, 6 hours 54 minutes; and that in Fig. 7, 4 hours 15 minutes.

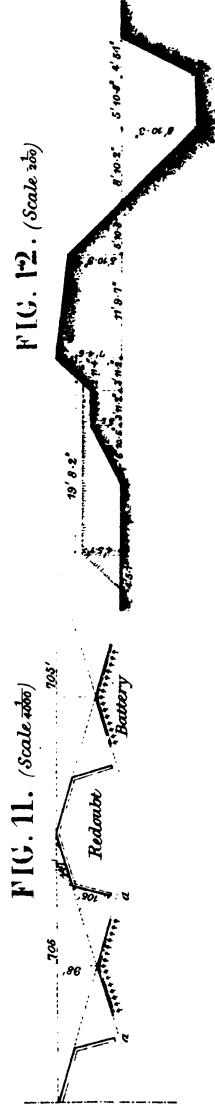
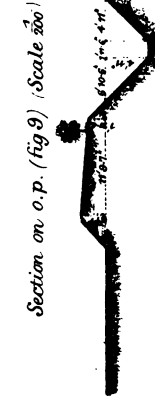
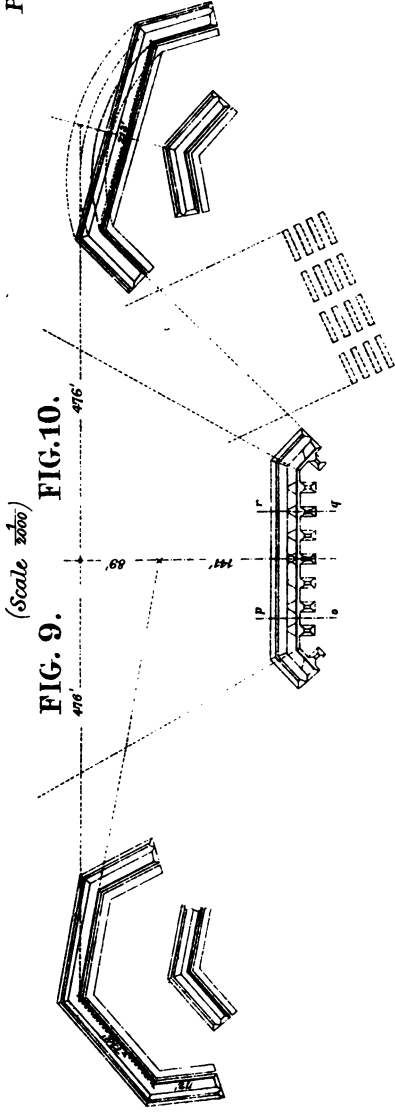
This time would be reduced by one-third if the men were frequently relieved, and by half if they were working under the influence of the intense excitement produced by imminent danger.

¹ Under the same conditions the Engineer clears away 11 cubic feet.

An Austrian military journal (*Oest. Mil.-Zeit.*, Sept. 1868) estimates the excavation at 22 cubic feet per hour for the Engineer when the work is of long duration, and at 33 when it is short.

The Infantry soldier, according to the same paper, does only the half of this work, and throws the earth half as far. These last figures are much nearer to those of Colonel de Pidoll than to those of Captain Richard. We consider them preferable, especially for profiles which require digging to a greater depth than 18 inches. According to the French figures, and distributing the workmen at the rate of 3 to $8\frac{1}{2}$ feet of trench, 1 hour 9 min. would be required to construct the profile in Fig. 5, 1 hour 42 min. that in Fig. 6, 1 hour 4 min. that in Fig. 7, and 5 hours 5 min. that in Fig. 12, Pl. 2. These times are evidently too short, unless the men are frequently relieved and are working under a powerful stimulus.

² Colonel de Pidoll maintains that by imposing this task on the men two or three hours were gained, and that they worked more willingly.



The Austrian profiles require more time and are less favourable to taking the offensive than the French.

The profile in Fig. 5, Pl. 1, takes with advantage the place of that in Fig. 12, Pl. 2, which was formerly made use of in field fortification. Although the latter requires an excavation of 365 cubic feet for each mètre in length, it may still be successfully employed in the construction of redoubts and other works of passive defence. In this case, the time of working may be reduced in a marked way by digging a trench at the foot of the slope of the banquette. This trench will allow of the number of workmen being doubled, and of masked shelter for part of the troops being formed in a short space of time;¹ but on the other hand it diminishes the quantity of earth to be furnished by the ditch, which thus becomes narrower and of less depth.

Shelter-trenches are not only useful for troops of the first line, but also for the most exposed part of the second. In certain cases it may even be necessary to have shelter-trenches constructed for all the troops in this line—for instance, when those in the first line are obliged to be on the *qui vive*; then the trenches of the second line will serve as a support for the first as soon as it is forced to retire.

Shelter-trenches may also be successfully employed to cover the troops in support of batteries, near which there is no artificial cover.

When the first line advances to carry out an offensive movement, its shelter will come in for the second line or the reserve. In case of failure it will afford the troops a place of refuge where they can rally, and then, by means of well-directed fire, check the enemy, perhaps even put him to flight, and resume the offensive.

In the last American war, and especially towards the end of it, there were instances of troops constructing several successive shelters, either because the lines had been displaced or because

¹ For this purpose it will be sufficient to cover part of the excavation with trunks of trees, and to face the slope on which the defenders are to sit or lie down.

the army had had to carry out changes of front in presence of the enemy.

The profile in Fig. 2, Pl. 1, reversed, is suitable for shelter for a battery, but in this case the mound should be from 2' 7" to 2' 11" high.

The detachments get under cover in little trenches (*rigoles*) hollowed out between the guns.

All the waggons which have to remain in the neighbourhood of batteries or troops in action may be sheltered in the same way. Captain Richard says, 'It will perhaps be sufficient for the waggons to improvise shelter by digging out in front of each wheel a sloping rut, allowing of its being buried up to the middle, and to heap up in front a small mound of earth.

'As Artillery is no longer forced on the field of battle to make such frequent changes of position as formerly, either to concentrate its fire or to follow the movements of enemies or friends, the batteries may sometimes be provided with a bullet-proof epaulment.'

Epaulments of this kind were constructed by the Austrians during the 1866 campaign, especially at Sadowa, where they were masked by branches planted on the glacis and the exterior slope. (See Fig. 8, Pl. 1).

The guns were in barbette, and were protected against oblique and enfilade fire by merlons, which served at the same time to cover small magazines. The communication with these magazines was by trenches, into which the detachments retired as soon as the guns were loaded.

Four hours were enough for the engineers to construct these batteries.

The shelter-trenches constructed in France were criticised as follows by General Faidherbe: ¹

'The width of the ditch at the bottom being only 3' 7", men

¹ *Revue militaire française*, August 1869.

in two ranks cannot stand there very easily, and there is no room for supernumeraries, &c.

‘This disadvantage is rather serious ; however, the parapet is sufficient protection against musketry, and the time required for its construction is certainly not too long. Unfortunately, this must be done by means of tools carried, not by the men themselves, but in waggons attached to each division ; and for that reason the system appears to us almost worthless.

‘In fact, a battalion which is expecting to be attacked, and wishes to obtain cover, must first ask the general commanding the division to give orders to the Engineers of the division to provide the tools, &c.’

Supposing each man to receive a tool, and to learn to make use of it as well as of his rifle, General Faidherbe proposes to adopt the following profile :

‘The digging is only $9\frac{1}{4}$ inches deep, but it is 13 ft. wide, so that there is room in it for officers, supernumeraries, drummers, trumpeters, &c. This is the detail for its construction :

‘Every man is furnished with a tool, there being twice as many shovels as pickaxes. The battalion occupies its position in line of battle, and has to throw up cover ; it gets the word : “Right about turn !” “Eight paces forward !” “Ground arms !” “Front !” “Eight paces forward !” The next command is : “Rear rank step back four paces !” “Each rank number from right of companies !” “Even files step back two paces !”

‘The men are then standing chequerwise, two paces from each other in every direction, which allows of each man working all round his own position.

‘The command is then given : “Take up your tools !” “Commence work !”

‘The whole of these preparations take about a minute ; 15 minutes afterwards the digging is completed and the parapet raised to a height of $3\frac{1}{4}$ ft.’

This result was obtained in Africa.

We must draw attention to the fact that General Faidherbe's profile necessitates the use of shovels with long handles, while that referred to in the Memorandum of April 17, 1868, can be constructed with short-handled shovels. On the other hand, a parapet $3\frac{1}{4}$ ft. in height offers greater difficulties in crossing than the regulation trench. These reasons are sufficient to condemn the new profile, especially the first, which is of itself decisive. In fact, the long-handled shovel weighs 4 or 5 lbs., and is in the way of a soldier when he has to cross a wood or travel in a railway-carriage. The tools of the troops would then have to be loaded in waggons or on requisitioned carriages, which would follow the columns a short distance off, a method of transport allowed by the French general himself to be inadmissible.

As for the supernumeraries, drummers, and trumpeters, we see no objection to their temporarily falling-in in the ranks when the battalion occupies a shelter-trench. They might also lie down on the reverse side of the trench.

Besides, we have proposed (p. 19) that the French shelter-trench should be widened.

The mode of construction proposed by Colonel de Pidoll, which consists in employing 2 men for every $3\frac{1}{4}$ ft. of trench, has the drawback that it more or less retards the work, by obliging the rear-rank man to keep behind the one in the front rank.

The excavation is more readily performed when the men are placed in one rank, a mètre apart, as is done in France.

But in this case one-third only of the force can be employed, that is, two companies out of six, and the trench is not constructed with the rapidity it is possible to attain.

The Austrian method employs two-thirds of the battalion, but in a less effective manner, since the men are too crowded, and can only be relieved half at a time.

In our opinion, in order to obtain the maximum of speed, and to make the work as easy as possible, the following plan should be adopted :—

Form up the battalion, every third file being provided with pick-axes and the remainder with shovels ; halt it four paces from the trench to be dug, open the ranks, ground arms, and lay down knapsacks.

When these preparations are made, the front rank advance with their tools ; each group of three takes a piece of ground 5' 10" long (being the width occupied by three men in the ranks). Two out of the three have shovels ; the third has a pickaxe, and places himself between and behind the others ; he picks the earth, throws with his hand on to the embankment the large pieces he loosens, throws back those which roll into the trench, and facilitates as much as possible his companions' work.

If the work were to last longer than twenty minutes (the time required for shelter-trenches in ordinary ground), the men in the rear rank, who had been lying down behind the arms, would take the place of those in the front rank.

The serjeants superintend the work of the squads, and the corporals, furnished with saws and axes, cut branches of trees in the neighbourhood, if necessary, to mask the trenches.

In this way the digging would be carried on along the whole front, with the assistance of all the soldiers. Half of them would watch over the others, and, should any unforeseen danger occur, the battalion would be under arms in less than a minute.

This mode of working would still suit if each file were provided with only one intrenching tool, as is done in Denmark ; only in this case the men on leaving the trench would leave their shovels and pickaxes there, instead of carrying them away.

CHAPTER III.

TRANSPORT OF TOOLS.

THE question of the transport of tools is a very important one.

Should every soldier have an intrenching tool, as was wished by Napoleon, and as is insisted on by the generals who took part in the War of Secession? Should part only of the troops be provided with them, as is thought in France and Prussia? Should the tools be carried in rear of regiments by special waggons, as has hitherto been done in most armies? Or, lastly, should defensive works be constructed by pioneers or Engineers, as was done under Charles V.?

The first method is on trial in Russia. In the Danish Army a tool is given to each file. The men make use of it alternately, and the duration of their work is only five or six minutes. Under these conditions a shelter-trench can be constructed in a quarter of an hour.

In Prussia the men belonging to the battalions of Jägers have a short-handled tool. In the United States Army the tools of each battalion are carried in turn by the men of two companies at a time.

This method is also, though only partially, employed in Russia. The first plan seems to us preferable to all the others, because by it the impedimenta are diminished, and the work is accelerated.

A soldier who is forming an excavation for his own protection is more vigorous and more careful in executing his task than one who is doing the same work for others. He has, too, more

confidence in the intrenchments constructed by himself, and he generally defends them with greater obstinacy.

The only objection that can be raised to this distribution of tools is that it overloads the soldier, who already carries in the field a weight of from 29 to 30 kilogrammes (64 to 66 lbs.¹); but on the one hand, by using sheet steel very good shovels with short handles may be made, which weigh only 1 lb. 14 oz., and on the other hand it appears easy to reduce by so much the weight of accoutrements and kit, which average 44 lbs.

Short-handled tools require the digger to work on his knees. This is but a slight drawback when the work is of short duration, and it is even an advantage when it is being carried out under the enemy's fire, as a man offers in this way a smaller mark for bullets and grape.

In France long-handled pioneers' tools, weighing about 4 lbs., are carried in rear of regiments.

The following are the official regulations on this subject:—

'In the field a company of sappers, provided with tools which are constantly carried by the men, is attached to each Infantry division. There are 36 shovels and the same number of pickaxes. This company has with it two waggons, called *voitures de section*, which contain between them, among other things, 94 round or square shovels and 38 pickaxes. Each division of Infantry has therefore 130 shovels and 74 pickaxes at its disposal.

'In addition to the divisional equipments each corps d'armée has a special store, containing 1,150 shovels and 542 pickaxes.

'Thus the total number of pioneers' tools at the disposal of a corps d'armée composed of three divisions is 1,540 shovels and

¹ During the Italian campaign the French soldiers carried a weight of nearly 68 lbs., viz. :—

| | |
|--|---------|
| Accoutrements and necessities | 44 lbs. |
| 60 cartridges | 5½ " |
| Tente-abri, rug, canteen, camp equipage, &c. | 11 " |
| Provisions for four days (exclusive of meat) | 7½ " |
| Total | 67¾ " |

764 pickaxes. This is sufficient for the simultaneous construction of shelter-trenches capable of containing 4,560 men.¹ Should the general have only two hours to spare, it will often be in his power in that time to place a division under cover.²

Captain Richard of the Engineers proposes to give pioneers' tools to two companies per battalion, and to have them carried in turn by all the companies. This proposition is something like that of Rogniat, who wished to give pioneers' tools as a mark of distinction to two picked companies in each battalion.³

In our opinion, either all the soldiers should be furnished with tools weighing from 1 lb. 10 oz. to 2 lbs., or else the men in the front rank only should be provided with them.

In both cases the number of shovels should be double that of pickaxes.

Saws and axes would be given to the corporals, and they would be carried in leather cases, as would also the pioneers' tools.

Temporary works of fortification, other than shelter-trenches, would be executed by the Engineers.

Although the construction of batteries is the duty of the Artillery, who can demand for this purpose the assistance of part of the reserve, yet it will be necessary, in many cases, to make the Engineers assist in the construction of magazines, bomb-proofs, revetments, and other special works for which skilled workmen are required.

These troops are likewise very useful for completing intrenchments roughly thrown up by the Infantry.

If we take into account the importance of the works which

¹ The principal *dépôt* (*grand parc*) of the army, the control of which is in the hands of the commander-in-chief alone, comprises 4,700 shovels and 2,200 pickaxes.

² '*Conférence sur le rôle de la fortification passagère dans les combats*,' by Major Prévost of the Engineers.

³ If there were any fear of overloading the men of these two companies, a light two-horsed van, similar to the Engineers' *voiture de section*, would have to be attached to each battalion. In mountainous countries this van would be replaced by three pack-mules.

constitute the special occupation of Engineers, we shall find that in most Armies they are not numerous enough in proportion to the duties they are called upon to perform. The Duke of Wellington was of opinion that there could not be too many of them, since the sapper can act as Infantry whenever he has no works to construct for which he alone is sufficiently fitted.¹

A good organisation would be to attach to each Infantry division an Engineer battalion of four companies, or one company per regiment.²

We think that it would also be advantageous to attach to each Cavalry division a troop of mounted Engineers, in order to destroy or re-establish communications,³ to form ambuscades, to intrench posts, &c., these operations being often performed by advanced or rear-guards, or when a body of Cavalry has to operate on the flanks of the enemy.

The proposal to give a pioneer's tool to each soldier has an importance on which it is needless to insist since the opinions expressed by Napoleon in his memoirs.

If this proposal had been acted on in his time, hasty intrenchments would have played an important part.

We will name only three instances in support of this opinion :

In 1809 Napoleon might have completely intrenched the villages of Aspern and Esslingen, which supported the flanks of his position beyond the Danube. No doubt these villages, surrounded as they were by only some small mounds of earth,

¹ The Engineers were employed in line at Balaklava and Inkerman. During the wars of the Republic and the Empire, they often took the place of Infantry for the defence of posts, *têtes de pont*, &c., and often fought by their side in advanced and rear-guards. In the campaign of 1870, their part was still more important and more varied, as may be seen by the reports of the Prussian generals.

² In time of peace, the battalions of Engineers would form regiments, which would be broken up again only in case of war and during important manœuvres at camps of instruction.

³ The War of Secession proved that it is often necessary, at great distances from the Army, to destroy a railway useful to the enemy, or to re-establish a line which he has cut.

made a very good defence, and saved the French Army, but what an amount of bloodshed would have been spared if powerful redoubts had protected the approaches to them !

The same reflection applies to the defence of Wachau and Probstheyda in the sanguinary battle of Leipzig. These two villages resisted to the last all the attacks of the Allies, but, in order to keep them, the French were obliged to retake them five times, and to sacrifice their best troops. If Napoleon had profited by the day of October 15 and the night of the 15th-16th to intrench them properly, the same result would have been arrived at with smaller losses.

At La Rothière, in 1814, the French Army had at its disposal the night of January 30-31st, the day of the 31st, and February 1 up to 2 o'clock in the afternoon. If, during this time, Napoleon had fortified Dienville on his right, La Rothière¹ in his centre, Chaumesnil on his left, and the hamlet La Gibrice in front of this wing, he would perhaps have held his position, in spite of the enormous numerical superiority of the Allies. In any case he would have lost fewer men, not only because intrenchments cover their defenders, but also because inhabited places so strengthened require a smaller force to occupy them.

¹ Napoleon confined himself to having the houses of La Rothière occupied and to constructing barricades in the streets.

CHAPTER IV.

INTRENCHED FIELDS OF BATTLE.

SHELTER-TRENCHES, ambuscades, and batteries constitute a partial application only of the principles on which hasty defences are constructed. The subject comprises also—

1. The placing of localities (such as villages, woods, defiles, isolated buildings) in a state of defence.
2. The construction of either open or closed works, intended to strengthen the important points of a field of battle.
3. The opening up of roads for the columns.
4. The establishment and destruction of bridges to assist either in the offence or the defence.
5. The turning to account of the ground in advance of the position, by the destruction of cover and by filling up excavations prejudicial to the defence.

As a rule, these works have to be carried out in the time which elapses between the end of a march and the commencement of an action, or before a battle which is to take place on the following morning.

The author who gave the earliest and best explanation of the conditions to be fulfilled by hasty intrenchments was General Rogniat.

‘There is no doubt,’ said he, ‘that the intrenchments in use at the present day require too much time for their construction; they are seldom in a state of defence when they are wanted. Supposing an Army to arrive and encamp in presence of an enemy, and immediately to set to work to fortify its position,

unless the intrenchments commenced in the evening can be finished during the night they are almost always useless, because on the following morning the enemy either makes an attack or else forces the defenders, by his movements and manœuvres, to change their position. It is, then, necessary, in order to fortify positions, to adopt a kind of intrenchments which do not require more than one night's work. It is true that such intrenchments are not shot-proof, but what does that matter? The principal point is, that they should afford shelter against grape, bullets, the sword, and the bayonet, which are all a hundred times more destructive agents than shot. Let us take into consideration that the gun is much less deadly than small arms, and we shall at once be convinced that the important point is to ensure ourselves from the effects of the latter. The palisades used by the Romans were not proof against catapults, and yet they never omitted to surround their camp every evening with this kind of intrenchment. . . .

'It is important to avoid shutting ourselves up in continuous lines, which would retard the breaking-out of the troops, by forcing them to pass through narrow barriers, under the enemy's guns, when, after having repulsed him, they want to dash out in pursuit of him; neither their movements nor their departure should be hampered. Turenne, who rarely omitted to fortify his camp, formed no continuous intrenchments; he covered it only by some redans, in front of which were abatis. These works, which were only trenches for putting his first line of Infantry under cover, were finished in a few hours' time. The tools he made use of, such as shovels, pickaxes, and axes, were carried on his dragoons' saddles.

'This is the kind of intrenchments we propose for fortifying, in the space of a night, the front and flanks of a camp or position. (See Pl. 2, Fig. 11.)

'The whole extent of front should be covered with bastioned redoubts, 255 $\frac{1}{4}$ yds. apart from salient to salient. Thus a front of 2,130 yds., necessary for the camp of an Army of 30,000 men,

requires 8 or 9 redoubts. By giving to each of these works faces of $53\frac{1}{4}$ yds. and flanks of $38\frac{1}{4}$ yds., perpendicular to the line of defence, we shall obtain detached bastions with a parapet 183 yds. long, reciprocally flanked at easy musketry range, and separated by intervals of $127\frac{1}{4}$ yds. Care should be taken in the details of their construction that the interior crest of the parapet is $6\frac{1}{2}$ ft. above the ground, so as to give good cover to the defenders; that the banquette, $4\frac{1}{4}$ ft. below the crest, is from 3 to $4\frac{1}{4}$ ft. wide; that the parapet is from $4\frac{1}{4}$ to $5\frac{1}{4}$ ft. thick at the top, and has a superior slope of one-fourth, and that the ditch is about $6\frac{1}{2}$ ft. in depth.

‘We must omit all the barbettes or platforms for artillery, which cause so much labour in the construction of ordinary redoubts. Our redoubts are intended only to receive Infantry; as for artillery, we would place it outside our bastions, behind epaulments, thrown up by way of a curtain at the point of intersection of the lines of defence; in this position it would be completely protected and defended by the musketry fire of the bastions on each side. This situation is in every way much more advantageous than the interior of the redoubts. In the first place, the guns are safer there, as the enemy cannot reach these re-entering batteries without having mastered the side redoubts; for how could he with impunity brave the cross musketry fire from their flanks 64 yds. off? Secondly, they defend the redoubts better, as they flank them, at a very short range for grape, by a grazing fire which strikes everything that shows itself, instead of the guns, placed in the faces of the works, losing sight of the assailant as soon as he has reached the edge of the ditch, or, still more, the bottom of it; thirdly, they distract and divert the fire of the enemy’s batteries from the redoubts by drawing it on themselves, so that our works, as well as their defenders, may be kept intact till the last moment, however weak their profile may be; and, lastly, what is the main point in war, batteries of this kind require but a very short time for their construction. The ground itself serving as a

platform for the guns, not more than $2\frac{1}{2}$ feet in height need be given to the epaulments, to $8\frac{1}{2}$ or $9\frac{1}{2}$ feet in thickness. But as it is important that the gunners should get under cover as soon as they have loaded, small transverse trenches, $2\frac{1}{2}$ ft. deep, intended to serve as a refuge for them, are cut at the side of each gun, at right angles to the epaulment ; this plan is adopted by the Russians and Prussians for their field epaulments. . . .

‘The redoubts should be united to each other by a trench with a banquette, similar to a siege parallel, which should extend from the ends of the flanks to the point of intersection of the lines of defence, in the shape of a broken curtain, so as to defend the redoubts as directly as possible, without masking their flank fire. Between these parallels and the flanks openings $10\frac{1}{2}$ yds. wide should be left for the sorties of Artillery and Cavalry. As for the Infantry, they can be made to advance to battle by crossing over the parapet of the trench, which should be provided for this purpose with some interior steps made of fascines.

‘As we have seen, 8 or 9 redoubts are necessary to cover the front of an ordinary camp of 30,000 men. Besides these, two others should be constructed on the flanks of the second line, so as to strengthen these weak parts of the position.

‘Such are our intrenchments ; the following are our dispositions for their defence : We place 15 guns in the interval between the two right-hand redoubts, and the same on the left, so that these two intervals are entirely given up to the reception of strong batteries intended to protect the flanks of the camp. The other 30 guns belonging to the corps d’armée remain in reserve, or else are distributed among the other intervals between the redoubts, at the point of intersection of the lines of defence.’

General Rogniat placed a battalion in each of the 9 redoubts, and one in each of the 6 trenches not occupied by Artillery. He thus placed the 15 battalions of his first line under cover ;

the 15 of the second line were drawn up in column at deploying intervals.

The light companies of the battalions posted in the redoubts were deployed as skirmishers. In case of attack they took refuge in the ditches of the redoubts, which they used like a covered way. A little banquette formed in the counterscarp enabled the men to fire.

The centre companies lined the parapet of each redoubt in two ranks, while the grenadier company formed a small reserve in the middle of the work, in readiness to throw itself on any assailants who might succeed in scaling the intrenchments.

The battalions placed in the trenches between the redoubts kept up a fire which was the more certain and lively because they incurred hardly any danger in firing from cover at an enemy exposed from head to foot.

If, in spite of these precautions, part of the camp were forced, the troops of the second line and those of the reserve played their usual part ; they advanced, re-took the captured redoubts, attacking them by the gorge which was left open for this purpose, and easily drove out the assailant, whom they surprised in the first disorder inseparable from a vigorous and deadly attack.

If the enemy were repulsed, the skirmishers rushed out of the ditch and pursued the fugitives ; the battalions in the trenches immediately came out in order of battle to support them ; they were followed in their turn by the battalions in the redoubts, who, after having left these works and crossed over the trenches quickened their pace, so as to regain their position in line ; the Cavalry and Artillery made use of the passages left near the flanks of the redoubts ; and the whole of the troops thus filed out of the camp without delay.

The following shows how General Rogniat calculated the time and the number of workmen necessary for constructing the intrenchments for an Army of 30,000 men.

‘ Experience,’ he says, ‘ teaches Engineer officers that a man

can excavate 9·7 cubic yards of earth in six or eight working hours; therefore, two workmen to every toise (2·13 yards) in length of tracing will excavate 19·4 cubic yards in six or eight hours, which provides more than sufficient earth for the construction of our intrenchments, according to the profile we have given them. By placing two more men to pick the earth which the first two have to dig, and two others to build up, shape, and complete the parapet as the earth is thrown out of the ditch,¹ every toise in length of the intrenchment will be finished in less than eight hours. Now if we multiply the length of parapet in toises (86) in each redoubt by six, we shall find that 516 workmen are required to construct it in six or eight hours. The trenches and epaulments require only two men per toise lineal to finish them in the same time. Now if, as in the proposed camp, the intrenchments are about 900 toises in length, and the trenches or batteries about 500 toises, it is easy to calculate that 6,000 workmen, or the fifth part of the Army, can easily finish the work in a night. Supposing that one-fifth of the troops are employed in guarding the camp and in outpost duty, the remaining four-fifths, working in turn at the intrenchments for an hour and a half or two hours, will each do a quarter of what is required, and the work will be finished in six or eight hours after it is begun.

‘Should the same camp be retained for several days together the redoubts may be strengthened by a row of palisades or by abatis fixed in the bottom of the ditch, as was done by Cæsar at the blockade of Alesia.’

The *bastioned lines with detached batteries*, described in Laisné’s ‘Aide-mémoire,’ differ but little from Rogniat’s intrenchments. (See Pl. 6, Fig. 5.)

¹ The construction of other intrenchments than shelter-trenches requires, besides the men digging, a certain number to pass the earth on, to ram it down and level it. Each piece of ground $6\frac{1}{2}$ feet long will, then, require in ordinary soil two men for excavating, one digger and two shovellers to pass the earth on, and one leveller and one rammer to shape and complete the parapet, glacis, &c.

These lines consist of bastions, intended for Infantry, and of curtains in the shape of trenches, so arranged that they can be easily crossed ; in the middle of each curtain is a redan armed with guns, which flank the faces of the adjoining bastions, and at each end of the curtains is an opening of 11 yards for the passage of Cavalry.

436 workmen relieved every two, or at most four hours, can construct $262\frac{1}{2}$ yards of these lines in a single night, and consequently give cover to a battalion of 400 files.

The profile of the bastion *AB* requires for every $3\frac{1}{4}$ feet of trace an excavation of $176\frac{1}{4}$ cubic feet, the profile of the curtain *CD*, $84\frac{3}{4}$ cubic feet, and the profile of the battery *ab*, $90\frac{1}{2}$ cubic feet.

The length of parapet in two demi-bastions is 188 yards ; it requires 344 men, 172 of whom have to pass on part of the earth and level it. The curtain, the length of which is $100\frac{1}{2}$ yards, requires only 92 men, all employed in excavating.

The curtains at the extreme ends of the intrenched line are each armed with fifteen pieces of ordnance, those in the centre have at most three.

‡ In the profile of the battery *ab*, the line *edt* indicates small trenches (*rigoles*), 4' 3.2" wide, dug between the guns, so that the detachments may get under cover as soon as they have loaded. In front of these trenches the parapet is the same, but the profile of the ditch is reduced to the dimensions shown in Fig. 6.

'This arrangement,' says Laisné, 'has at once the advantages of continuous lines and of lines with intervals.'

In our opinion they could only be of use in protecting the camp if an Army were forced to shut itself up when it could no longer keep the field. Frederick II. was situated thus when he fortified, in four or five days, the camp of Buntzelwitz, within range of the guns of the fortress of Schweidnitz.

For intrenching a field of battle we much prefer the arrangement recommended by Colonel de Pidoll, in the *Oestreichische*

Militairische-Zeitschrift of 1868, which is very like that of Rogniat, and of which a partial application was made at Sadowa. (See Fig. 9, Pl. 2.)

The ideas of the Austrian colonel may be summed up as follows :—

The configuration of the ground and the disposition of the troops determine the choice of positions for the Artillery. In advance of these positions and clear of the line of fire of the guns, there should be cover for the Infantry.

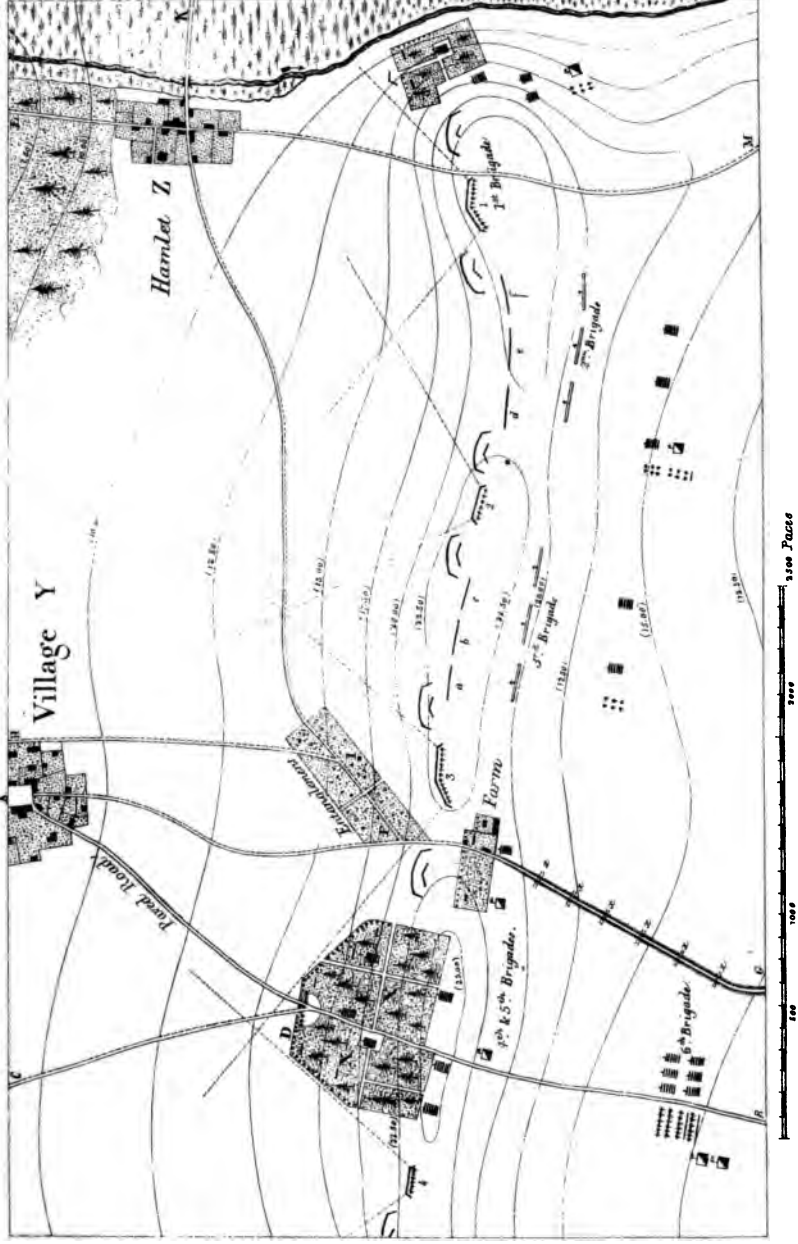
This may be arranged by means of a bastioned intrenchment, the curtain of which is occupied by the Artillery, and the bastions of which serve to shelter the supporting troops.

The faces of the bastions are from 50 to 60 paces, and the flanks from 25 to 30 paces in length, so that each bastion can contain a company of from 150 to 180 men, drawn up in single rank and one pace apart.

In rear of each bastion is a blindage of the same profile, and about 70 paces in length, in the inner ditch of which is placed a company intended in the first place to relieve the men firing in the first line ; secondly, to increase the fire (by means of groups of skirmishers) in those parts where the ground is not sufficiently swept by the bastions ; thirdly, to form a line of skirmishers on the outer flanks ; fourthly, to act as a support, and to detach small columns on the flanks of the battery ; and lastly, to fire volleys when the first line is taken, and to defend the second line if the reserves are not too far off.

These works may be constructed in the space of a night, like those of Rogniat. The advantages they offer are as follow :— They do not hinder the movements of the troops ; they can be strengthened by degrees ; they give the enemy no marked superiority when he has taken them ; the riflemen placed in the bastions protect the Artillery from the fire of skirmishers, and are themselves protected by the fire of the guns.

In our opinion this arrangement, like that of Rogniat, has the



N.B. The Contours are shown in Meters (each 30 ft.)

Henry S. King & Co. 45 Cornhill, London.

Artillery. Heavy Intrenchments

disadvantage that it forces the redoubts to assume a trace which has some of the defects of a bastioned front.

The object would be better arrived at if the two faces of each bastion were replaced by a single line, either straight or curved, joining the shoulders. (Fig. 10, Pl. 2.) This line would, in fact, give more fire in the direction from which the enemy's troops have to attack the bastions. The other arrangement certainly affords a better protection for the ground in front of the guns, but it is not over this ground that the assailants will advance. It is, in fact, in accordance with the principles of tactics to attack batteries in flank and in reverse, while skirmishers, properly covered or concealed, keep up a direct fire against them. Now attacks in flank and in reverse can only succeed after the bastions are taken. Therefore the ground in front of these works should be swept as effectually as possible.

Let us apply the above arrangements to the defence of a front occupied by a corps d'armée of 33,000 men, composed of 6 brigades of 6 battalions each, of 6 regiments of Cavalry of 4 squadrons each, of 12 field batteries and of 3 batteries of Horse Artillery, of 6 guns each.¹

Let us suppose that this corps d'armée is occupying the right of the field of battle, and that it is resting on a small river, bordered by marshy meadows. (Pl. 3.)

The nature of the ground is such that by occupying a hill which extends from the wood to the river, the troops and batteries in the first line can see the ground in front of the position, and command the plain, in the centre of which is the village *T*.

The roads leaving this village cross the left of the position; the most important of them is paved, and leads to our Army's line of retreat. It is, then, probable that the enemy will attack

¹ If we calculate the extent of the position at the rate of $3\frac{1}{4}$ ft. for twelve men, we obtain a total length of about 3,000 yards; this is the minimum, for in recent campaigns not more than six or eight men are reckoned for every $3\frac{1}{4}$ ft. in length of the position.

on this side. If he directed his principal efforts towards the right he would, in case of defeat, risk being driven into the river.

With these data the left of the position will be more carefully intrenched, and more strongly occupied.

On the right we shall limit ourselves to putting in a state of defence the little wood alongside the river, and to establishing a strong battery at right angles to the road *L M*, which issues from the hamlet *Z*.

This hamlet and the village *T* are too far from the position for it to be of any use to defend them. They will only be occupied by detachments of light troops, who will watch the enemy near at hand, and will give an account of the first dispositions he makes for the attack.

If these villages commanded roads or important passes by which the enemy must necessarily debouch on the position, they would be carefully intrenched, and would in that case form advanced or detached posts, according as they were flanked or not by the Artillery of the line of battle.

The wood *X*, the farm situated behind the right of this wood on the road *A G*, and the little wood on which the extreme right of the first line rests, are 'tactical pivots,' that is to say, they are important points included in the line of battle itself.

The key of the position is the plateau on the side of which lies the wood *X*. As soon as the main body of the enemy's force occupies this plateau, the whole of the right wing will be overcome and cut off, unless it makes in time a change of front in rear.

We must, then, strongly organise the defence of the wood *X*, and mass the reserve in proximity to it.

Three battalions of the 4th Brigade will man the edge with skirmishers and supports; the other three battalions, forming the reserve, will occupy the wood, and remain close to the roads passing through it.

As it is important to enfilade the high road *A B*, and the road

CD, a field-battery will be placed, either behind an epaulment in front of the wood, or else in the wood at a few paces from the edge, so as to see the enemy without being seen.

In the latter case the trees should be felled for some distance behind the battery, so as to facilitate its retreat, and so to give the gunners enough confidence to fire till the last moment.

An excellent method of strengthening the defence of the wood would be to protect the border by a line of felled trees, interlaced with iron wire.

An abatis might also be formed on the other side of the road which crosses the wood parallel to the battle front.

The first regiment of the 5th Brigade, formed in battalion columns, would be drawn up behind the wood, ready to throw itself on the troops who endeavour to force their way through or turn it. The second regiment would place one battalion in the château with wooded park which bars the road *AG*, a second behind the château, and the other in the intrenchments of No. 3 Battery.

Two of the sides of the wood would be flanked by Nos. 3 and 4 Batteries. In order that the latter may see all the ground situated between the village and the wood *X*, we should be obliged to cut or burn down a little wood situated in front of the battery, at the intersection of the roads *KI* and *HI*.

Nos. 3 and 4 Batteries should be protected by means of intrenchments constructed as shown in Fig. 10, Pl. 2, in which two battalions would be placed.

The 3rd Brigade would have its front covered by Nos. 2 and 3 Batteries, and by the intrenchments which support them. One of its battalions would occupy the intrenchments of No. 2 Battery.

The 2nd Brigade would be behind Nos. 1 and 2 Batteries.

Lastly, the 1st Brigade, on the extreme right, would place one of its regiments in the wood alongside the river, and the other in second line on the left of the wood. The first battalion of the latter would serve as a support for No. 1 Battery.

The positions of Nos. 1, 2, 3, and 4 Batteries are chosen in such a way that the ground in front of the position, and the roads which cross it, may be swept as much as possible.

The battalions of the first line, deployed, would remain behind the crest of the hill to escape from the enemy's sight, and from part of his fire. When the time for action arrives, they would proceed in rear of the shelter-trenches *a, b, c, d, e, f*, constructed in the intervals between the batteries.

The troops of the second line would remain 400 or 500 paces from the first on the rear slope of the ground, where they would be sufficiently sheltered.

We must avoid placing any of them behind Nos. 1, 2, 3, and 4 Batteries, so as not to expose them to the projectiles with which the enemy would be sure to overwhelm the batteries as soon as their fire became harassing.

The reserve, composed of the 6th Brigade, two regiments of Cavalry, and 4 batteries, two of which should be Horse Artillery, would be drawn up about 1,500 paces from the wood on the road *A B*.

In order to facilitate the passage of the troops towards the right of the field of battle, some openings, *x, x, x, x*, should be made in the hollow road *F G* which interrupts the communication between the two wings of the position.

The Artillery would be placed in the following manner:—

One field battery on the border of the wood *X*, six behind the epaulments of the first line, three in second line behind the 1st, 2nd, and 3rd Brigades, and two in reserve.

One of the three batteries of Horse Artillery would be behind the 2nd Brigade, and the others in reserve.

One regiment of Cavalry would be posted in rear of the 1st Brigade, one in rear of the 2nd, one behind the park belonging to the farm, one behind the wood, and two in reserve.

The defensive works we have just described constitute an application of Rogniat's system, completed by the employment of shelter-trenches.

We are of opinion that better still might be done. A series of intrenchments open at the gorge, which must be abandoned as soon as the line of battle is pierced, do not form, in our opinion, a perfectly satisfactory arrangement. What we propose to substitute will appear later on.

The question of the defence of positions is widened considerably when a complete field of battle has to be fortified.

Before commencing to enquire into it, let us establish some principles.

It is *à priori* evident that the defensive works of a position must be in accordance with the plan of the battle. These works can, then, only be determined upon and ordered by the Commander-in-Chief.

Every position has a defensive front and an offensive front, that is to say, that the front of an army ready to give battle has one part more favourable for defence, and another more favourable for attack. Positions may, no doubt, be named, the front of which may be made as readily offensive as defensive, but they are exceptions which do not invalidate the rule, and which it would be dangerous to transform into examples.

A skilful general will always select positions in such a manner as to assure to himself the advantages of the ground, or, in other words, so as to strengthen part of his front that he may occupy it with fewer troops, and concentrate the bulk of his forces on the other part, which is disposed for offensive operations.

As victory can only be the result of a successful attack, it is important to have the greatest possible number of troops ready at the decisive *point* and *moment* of the battle.

In the opinion of some military men 'shock tactics,' which were long in favour, must give place to 'fire tactics.' This is a mistake; neither the one nor the other is good separately and exclusively. Actual collision must be prepared for by firing, and firing alone cannot lead to victory.

To attack at the right time will always be the grand secret of tacticians.

An Army which is too weak to fight with equal chances can only avoid collision in a fortified position.

It is a matter of course that this position must be intrenched quite differently from that of an Army which is in a condition to take the offensive. In organising the defence of the latter the Engineer's principal object must be to come to the assistance of the attack. He will attain this by strongly fortifying the part of the front where the Army will remain on the defensive, so as to render more troops disposable for occupying the part whence it will issue at the time for attacking.

A position is under the best possible conditions when it presents this combination of offensive and defensive fronts.

The defensive front is the part, the approach to which presents most difficulty, either because the ground is covered with obstacles, or because the Artillery occupies more favourable positions on that side.

The offensive front requires ground which favours the prompt and decisive action of large bodies of troops.

The object of fortification on the defensive front is to keep the enemy in check as long as possible, without employing many of one's own troops.

The object of fortification on the offensive front is:—1st, to shelter the troops of the first line up to the moment when everything is prepared for the attack, and 2nd, to receive these troops if they are driven back after failing in an attack, to check the pursuit, and to prevent the enemy from establishing himself in the positions he has just taken.

We must, then, dispose our defensive works in such a manner as to deceive the enemy as to our plans, and as to the strength of our position.

'To attain this object,' says an Austrian officer,¹ 'we must give an offensive appearance to the defensive wing, or we must construct it projecting in front of the other, or else we must bring

¹ *La fortification appliquée au champ de bataille*, by M. Millinkovie, an officer of Engineers; see the *Oesterröichische Ungarische Wehrzeitung*, 1868.

it so near to our line of retreat that the enemy may be tempted to cut us off from our base of operations. In any case the defensive front must comprise the keys of the position.'

These recommendations must not, however, be taken too literally. Nine times out of ten, the enemy, at the first glance he casts on our defensive works, will understand our intentions, and will know by which wing we expect to attack or to be attacked.

It would even amount to an error if, in order to induce him to approach the defensive front, we were to choose it near our line of retreat, for we should thus give him an opportunity of striking a decisive blow, and routing our army after a single engagement.

On the offensive field of battle, shelter-trenches and epaulments need be constructed for a part only of the battalions and batteries of the first line. Large intervals permit the troops and guns to advance without delay and in order of battle to meet the enemy. With this object, the ground in front of the position should be cleared, any prejudicial excavations filled up, the hedges cut, and passages opened in the woods to facilitate offensive movements.

Intrenchments are especially useful in case of reverses. They mark a limit for the backward movement ; the troops halt there, and rally of their own accord, because it is a point of honour to defend them ; order is re-established, confidence is renewed, the tactical union between the columns is re-formed, fire is opened, the pursuit comes to an end, and, if all is well, even the offensive may be once more taken.

In order to retard the pursuit it would be well to establish batteries along the defensive front which would take the enemy's columns in flank or in reverse when they approach the offensive front. With the same object it would be advantageous to occupy posts (farms, enclosures, groups of houses, &c.) along the offensive front in proportion with our advance. These posts, defended by weak detachments, would be of great use in the event of retreat. They would separate the attacking

columns, and would force the enemy to delay his advance until he had taken possession of them.

Works would likewise be constructed in the second line, should the ground rise in rear of the position sufficiently to allow of the defensive works in the first line being thence fired down into, of one of the wings of that line being protected, or of an important approach to the field of battle being swept.

If the decisive tactical points of the Army were occupied by works open at the gorge the enemy would experience less difficulty. It would be enough for him to repel the troops who have sallied out in advance of the offensive front, and for him to push the heads of his columns beyond the works, and the defenders would be forced to abandon them. Experience proves indeed that the support of troops in retreat cannot be counted on. In the midst of danger everyone thinks of himself alone.

From this may be deduced, we think, this principle—that it is necessary completely to close works which occupy the principal tactical points, and to entrust their defence to picked troops, supported by an interior and an exterior reserve, the latter hidden close by, and holding itself in readiness to fall on the assailant either in flank or in rear.

General Rogniat, Colonel de Pidoll, and other Engineers are opposed to this principle.

The objections to which closed works are liable are as follow :—

1st. The Artillery which occupies them cannot be withdrawn quickly enough, and the horses cannot be put under cover in them.

2nd. The interior space not being sufficient to shelter the limbers and waggons, magazines must be constructed for the ammunition.

3rd. They require a more substantial profile and a greater command (8' 2·4" to 9' 10·1"), and, notwithstanding this, the gorges, flanks, and interior space are not protected.

4th. It is more difficult to retake them by resuming the offensive.

5th. The batteries placed in them lose their mobility, because the guns have to be placed on platforms raised above the ground. These objections are immaterial, as we shall easily prove.

In works open at the gorge the guns are exposed to being captured, destroyed, or spiked ; a temporary success is sufficient to bring this about.

In closed works the Artillery is safer in this respect. Its retreat certainly is more difficult, but when only a small number of guns are put in them, there is no occasion to take into consideration the losses that will ensue on the capture of the works. Besides, to attain an important object it is allowable to sacrifice entire batteries. The Austrian Artillery lost more than a hundred guns at Sadowa, through striving to protect the retreat up to the last moment, and its conduct was unanimously praised.

The disadvantage of not being able to shelter the limbers, waggons, and horses, exists to the same extent in works open at the gorge, unless there are close at hand either undulations of the ground or other cover to protect the carriages and horses.

A closed work need not necessarily have more relief than one open at the gorge. When a redoubt is to be constructed we commence by giving it a minimum command and profile ; afterwards these are both strengthened, if time allows it, and it is only at the end that barbets and platforms are constructed. The latter have no doubt the drawback that they prevent the artillery from moving readily, but, on the other hand, they facilitate the firing, and give the guns a greater command over the country.

A work open at the gorge is incontestably easier to retake, but it is also more easily taken in the first instance. Nine times out of ten it is enough to outflank it with a column of troops to oblige its defenders to leave it.

Among the incidents of war which bear witness in favour of

the employment of closed works we may mention the battles of Pultawa, Jemmapes, Caldiero, Borodino, and Toulouse.

However, these works have a real value only when they can be carefully constructed and armed with heavy guns. The positions which the enemy must necessarily attack and those situated in the neighbourhood of a fortress are the only instances of this. They are intrenched beforehand, the troops in the reserve or the inhabitants of the neighbouring places being employed at them. It is in this way that the majority of the redoubts that have played a part in field warfare were constructed.

As a rule the only time available for fortifying a field of battle is what elapses between the end of a march and the beginning of the attack. If the time for necessary repose be deducted from this, there remain scarcely six or seven hours.

Under these circumstances redoubts must not be constructed, because on account of their depth, and their lines exposed to ricochet and reverse fire, they give no safety to the defenders, unless they have a good relief above the ground and a sufficient number of blindages.

The inferiority of redoubts in this case is very well explained by the following note addressed to us by Colonel de Pidoll :—

‘Redoubts of the most simple form, having a relief of 6'4.7" above the ground and flanks of $91\frac{1}{2}$ feet, constructed on level and easily-worked ground, and provided with the obstacles indispensable for putting them in a state to oppose some resistance to an attack by assault, require 560 men working for 5 hours, or 2,800 hours in all. These redoubts have room on the faces and flanks for 4 guns and 120 Infantry, or 200 men altogether.

‘If on the same ground three sunken batteries were constructed for 8 guns each, three times 290, or 870 hours of work would be wanted ; if we deduct this number from the 2,800 hours required for the construction of the redoubt, we find 1,930 hours disposable, which would be sufficient (allowing a loss of time of 50 per cent.) to excavate shelter-trenches 4,825 paces in length.

‘It follows that with the same number of workmen, and in the same time, we could erect either a redoubt armed with 4 guns, or else shelter for 24 guns and 4,825 men.’

With regard to these figures, Colonel de Pidoll is of opinion that we should begin by throwing up all the cover for men and guns which is necessary on the front of the position; it is only after this first want has been provided for that we can occupy ourselves with the construction of redoubts:—

- (a) On the decisive points of the field of battle.
- (b) At the wings.
- (c) In second line.

We admit these conclusions, with the exception, however, that the redoubts may be thrown up at the same time as the cover in the first line, which will almost always be possible.

If it be foreseen that there will be no time to give the redoubts a good profile, measures must be taken to protect them from direct and flanking attack by abatis, or by a network of wire attached to pickets driven irregularly into the ground, a most effectual means of defence, of which the Americans and Prussians made very good use.

It will in future be necessary for every corps d’armée and even every detachment to take with it into the field some rolls of this wire, with which auxiliary defences may be rapidly constructed, as formidable for men as for horses.

The fortification of the defensive front requires a larger number of works, and more important ones.

The object to be attained is the following:—To ensure the maximum of effect for our fire, and to obtain a good resistance with few troops.

The works should, then, be so disposed that the enemy may be obliged to divide his forces and to advance slowly in the directions swept by our Artillery.

In the same way as on the offensive front, the shelter-trenches should be combined with batteries and closed works; only as on this side there is no question of taking a decided offensive,

the obstacles should be placed nearer together, and more importance should be given to the fortification of localities (villages, farms, woods, &c.), as well as to auxiliary defences.

The principal disadvantage of closed works (giving the enemy decisive tactical points when he has made himself master of them) disappears when there are heights in rear of them on which batteries may be placed to fire down into them.

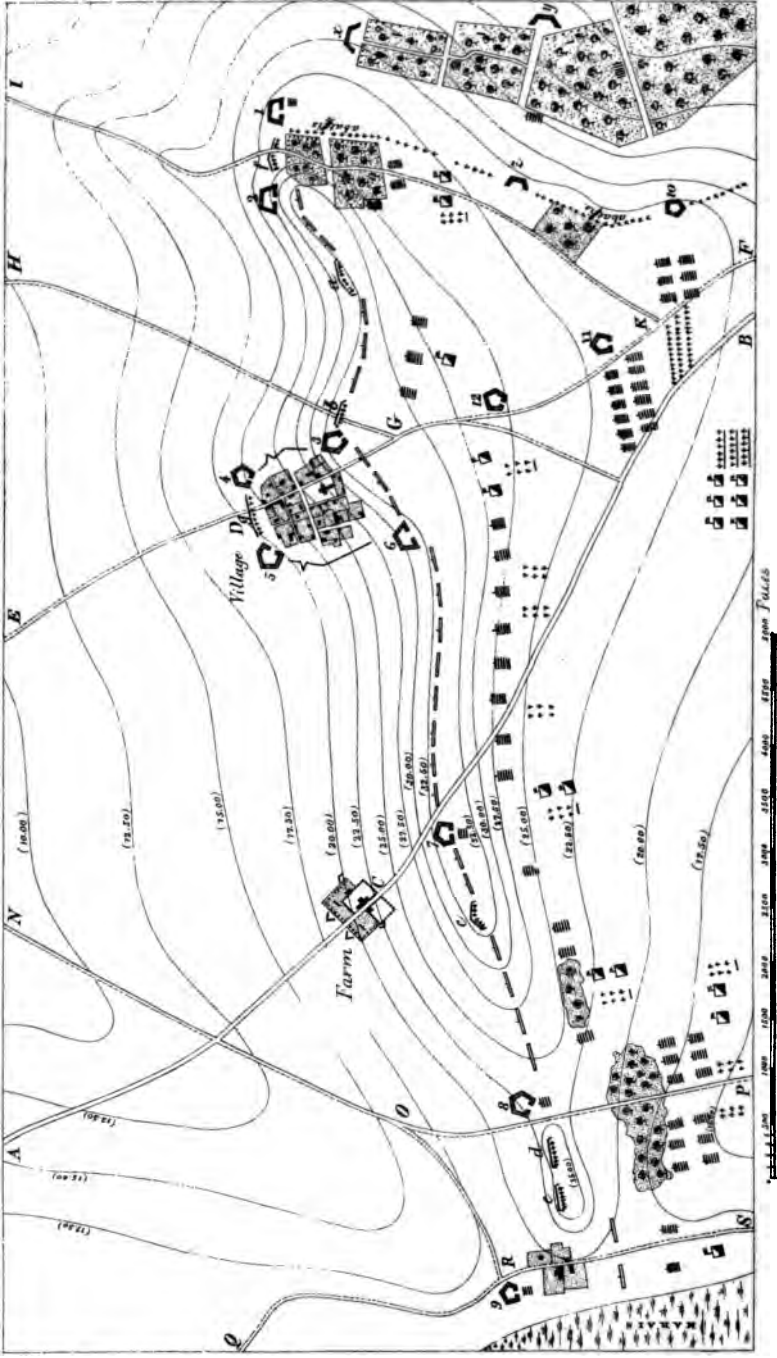
As the use of rapidly-firing rifles increases the importance of intrenchments, we can diminish the strength of the exterior reserves, and even content ourselves with one reserve for several works. In the latter case, however, the one reserve must be composed of mounted troops, whose action is quicker and more decisive.

There is no fixed rule to determine the dimensions of the works, nor the distance they should be apart. The essential points are to sweep the ground well, and to occupy the decisive points strongly.

The following would be a good arrangement :—Small advanced works (*flèches* or *lunettes*) sweeping the principal approaches ; within rifle range in rear, the principal line of obstacles, composed of shelter-trenches, epaulments, abatis, networks of wire, rifle-pits, and closed works ; sometimes in second line batteries and redoubts to cover a retreat or a change of front.

All these works must be executed quickly and, as far as possible, without the knowledge of the enemy.

A wood, the border of which is strongly occupied, and defended by a line of abatis, may be of great use in concealing part of our lines and movements from the enemy's sight, in giving him wrong impressions as to our strength, and in forcing him to make a great display of his troops in order to take it. Nevertheless, if the wood be too large it loses these advantages, because the watching over it becomes too difficult and its defence too weak, in consequence of the scattering about of the supports and reserves.



N.B. The Contours are shown in Metres (each 3 ft.)

In order to flank the principal borders, light guns, covered by epaulments, are posted in the salient parts of the wood.

If there be no such salient parts, the flanking is ensured by means of redoubts or *flèches*.

On the offensive front woods are, as a rule, prejudicial, because it is difficult to issue from them with strong columns, and more difficult still to cross them in good order when these columns are repulsed. Almost always in the latter case the troops disband when they reach the edge of the wood, which changes the retreat into a thorough rout.

On the other hand, the groups of trees are very useful for concealing part of the supporting troops, and for giving the enemy wrong impressions as to our strength and our plans.

The same remark applies to intrenched villages.

On the offensive front they impede our movements and separate our columns, which is particularly dangerous when the enemy is within range of Artillery; they require a large number of troops, and are sometimes commanded by the ground occupied by the enemy.

In order to apply these general principles to a definite case, let us suppose that we have to fortify a field of battle for an Army of 100,000 men, composed of 16 brigades of 6 battalions each, 18 Cavalry regiments of 4 squadrons each, 8 Horse Artillery and 24 Field Batteries of 6 guns each. (See Pl. 4.)

The position chosen for this Army is a hill, the outer ridge of which forms an angle of about 45° with the line of retreat *A B*. The left rests on a marsh, the right on a small wood. Behind this wing is a large wood, which must be looked upon as prejudicial to the defence, because it is favourable to a flanking movement.

By attacking the right of our position the enemy may hope to cut us off from our line of retreat, and thus obtain a decisive success.

It is, then, on this side that we must concentrate the bulk

of our forces, and oppose the assailant with all the resources of defensive art.

The most certain way of fortifying a salient which the enemy can surround and outflank is to construct defences which take this salient in reverse, and others which enable the ground in rear to be disputed foot by foot.

This double object will be attained—1st. By intrenching the village *D* in the centre of the line of battle, and by posting a battery, *x*, in front of the large wood on the right wing. 2nd. By constructing to the right and left of the little wood the redoubts numbered 1 and 2, in the interval between which is posted the battery *f*, which is wanted for sweeping the ground outside, and especially the road *IK*. 3rd. By constructing the redoubts 10, 11, and 12 in rear of the right wing, to form a second line of defence.

A flank attack may be prevented by occupying the large wood, by constructing a battery, *y*, to flank its outer border, and by forming a line of abatis under the protection of the redoubts 1 and 10 and of the battery *z*, posted in the interval between these redoubts. This battery and the redoubt 10 are opposite to the principal outlets from the wood.

It is important that between the line of abatis and the inner edge of the large wood there should be an open space at least 320 yards wide, to give play to musketry fire.

That part of the front which is comprised between the extreme right and the village *D* forms the defensive, and the remainder the offensive front. By attacking from the latter we can cut off the enemy from his line of retreat *AC*, and force him back on to the roads *HG* and *IK*, which remove him further from his base of operations.

The defensive front, projecting beyond the offensive, ensures a very effectual protection to the latter. An attack on this side would not have even a chance of success as long as the village *D*, and the redoubts 10, 11, and 12 were in our power.

We have still to explain the nature and position of the works for each part of the battle-field.

The extreme right would be defended by the battery *f*, and the redoubts 1 and 2.

On the border of the small wood a line of abatis would be placed, under the protection of the redoubt 1.

The ground comprised between the roads *IK* and *EG* would be swept by the batteries *a* and *b*. In the interval between these batteries, shelter-trenches for six battalions would be constructed.

The redoubts 3 and 6 are necessary to sweep the flanks and rear of the village. Shelter-trenches for three battalions join these two redoubts together.

We shall see further on how the local defences should be organised. For the present we will content ourselves by remarking that the front of the village would be protected by a battery, *y*, which enfilades the road *EG*, and that its sides would be defended by intrenchments with a proper flanking arrangement (either with bastions or *tenailles*).

The redoubts 10, 11, and 12 are accounted for by the necessity of covering the most exposed side of our line of retreat, and of creating points of support in case our right wing should be broken or outflanked.

They would likewise be very useful if the enemy were to attack our centre or left (or both together). In fact, in the latter case the Army might take a new and very good position by 'refusing' its left wing, and establishing itself behind the redoubts 10, 11, and 12, its right flank resting on the village, and its left on the large wood.

The fortifications of the offensive front would be composed of shelter-trenches, batteries, and redoubts.

The battery *c*, which occupies the end of the hill, fires obliquely on the road *AB*, and the ground to the left of the farm *C*. The batteries *d* and *e* occupy a small hillock between

the roads *NP* and *QS*. They would be of great use if our left wing were repulsed and pursued by the enemy.

The redoubt 7 enfilades, and also fires obliquely on, the road *AB*. In order to dispute this important road with the enemy it would be necessary to intrench the farm *C*, which forms an excellent advanced post whence the central part of the line of battle can be taken in reverse.

The redoubt 8 sweeps the road *NP* under the same conditions, and the redoubt 9 occupies a favourable site at the intersection of the roads *QR* and *OR*.

To flank the batteries *d* and *e*, and to dispute the road *RS* with the enemy, a group of houses situated in rear of the redoubt 9 would be strongly occupied.

The defensive works we have just described, taken as a whole, offer all the security that can be wished for; they are more in accordance with the conditions named above for the defence of a corps d'armée than is the arrangement shown in Pl. 3. The redoubts may even be outflanked and taken in reverse, without their garrison being obliged to abandon them; they are therefore preferable to Rogniat's intrenchments for offensive returns, and for defending the field of battle foot by foot.

The farm *C*, situated 1,094 yards in front of the left centre, and the village *B*, 328 yards in front of the right centre, are the advanced posts of the position.

The group of houses behind the redoubt 9, and the little wood on which the extreme right of the line of battle rests, are the 'tactical pivots.'

With regard to the distribution of troops we will make but few observations, as it is not our object at the present time to explain the principles which govern this branch of tactics.

The large wood behind the right wing is guarded by the 1st Infantry Brigade.

The little wood, which serves as a support for this wing, and the shelter-trenches constructed between the redoubt 1 and the battery *a*, are defended by the 2nd Brigade. In rear of this

little wood are stationed two Cavalry regiments and one battery of Horse Artillery.

The 3rd Brigade and a regiment of Cavalry occupy the interval between the batteries *a* and *b*.

The 4th Brigade has one regiment in the village *B*, and the other forms the reserve. In second line are two Cavalry regiments and one battery of Horse Artillery.

The 5th, 6th, and 7th Brigades, 2 regiments of Cavalry, 1 Horse Artillery and 3 Field Batteries defend the space between the redoubts 6 and 7.

Lastly, the 8th, 9th, and 10th Brigades, with three regiments of Cavalry and one battery of Horse Artillery, occupy the left of the field of battle.

Behind this wing, concealed by a small wood, lies a partial reserve, composed of the 11th and 12th Infantry Brigades, 2 Cavalry regiments, 2 Field Batteries and 1 of Horse Artillery.

The general reserve, composed of the 13th, 14th, 15th, and 16th Infantry Brigades, 6 Cavalry regiments, 8 Field Batteries and 3 of Horse Artillery, is placed behind the right centre of the field of battle, on both sides of our line of retreat.

CHAPTER V.

INSTANCES OF FORTIFIED FIELDS OF BATTLE.

AS instances of fortified fields of battle we will take Allerheim in 1645, Fontenoy in 1745, Caldiero in 1805, and Borodino in 1812.

I. ALLERHEIM.

In the angle formed by the Warnitz and the Eger are two hillocks about 3,280 yds. apart. (See Pl. 7.) One is called Winneberg and the other is crowned by the Château of Allerheim. In the valley between the hillocks is the village of Allerheim, which is a short distance from Nordlingen. It was in this strong position that Mercy resolved to await the French. His Army numbered 16,000, and that of Condé 17,000.

The right of the Allies, composed of Bavarians, crowned the Winneberg and rested on the Warnitz; the centre was about 220 yds. behind the village, and the left, under the orders of Jean de Weert, occupied the hill on which the château stood.

Some intrenchments constructed in a few hours on the two hills round the village, and in front of the centre of the line of battle, completed this formidable position.

Military historians affirm that the arrangements made by Mercy to defend the front of his Army would have secured the victory for the Allies but for a wrong movement made by Jean de Weert.

II. FONTENOY.

This was a battle between 56,000 French, under Maurice de Saxe, and 50,000 English, Hanoverians, and Austrians, under the orders of the Duke of Cumberland.

Marshal Saxe had only one night to organise the defence of his position. (See Pl. 8.)

As the village of Fontenoy, situated at the apex of the angle formed by the line of battle, was the point most exposed to attack, it was intrenched with especial care. The extremities of the line were protected by fortifying the village of Antoing, on which the right rested, and by forming abatis, supported by two redoubts, *a, a*, in the wood of Barry, on which the left rested.

The village of Antoing, on the right bank of the Scheldt, was flanked by six 16-pounders, posted on the other bank. In rear of the position a *tête de pont* had been constructed, so as to ensure the retreat of the Army, if necessary.

Marshal Saxe profited by the little ravines or hollow roads which were to be found on both sides of Fontenoy to cover one part of his line of battle; in addition, he had several redoubts constructed right and left of the village to strengthen the parts which were not protected by the natural configuration of the ground.

Noizet de Saint-Paul remarks: 'No combination could be better than this defensive arrangement; it denotes great accuracy of judgment; in spite of the shortness of the time, nothing indispensable to the defence is forgotten. But whether from thoughtlessness or recklessness on the part of those charged with the execution of these works, the redoubts *i, i, i*, were constructed on the right only of the village; the left remained unprotected, and this mistake all but caused the loss of the battle, as the English Army passed between the redoubts *a, a*, of the wood of Barry and the ravine to the left of Fontenoy.'

III. CALDIERO.

Archduke Charles, wishing to arrest the advance of Masséna, occupied in force a hill about 5 miles from Verona, which was somewhat cut up by ridges and shallow valleys. He had constructed, at all suitable points, redoubts and batteries which

reciprocally flanked each other, and the fire from which reached to the bottom of the ravines. 'All these works,' says Mathieu Dumas, 'were united, and they extended as far as the Adige, the course of which, winding from west to east above Verona, confined and strengthened the left of the position. No projecting point or hillock could be seen which was not armed with artillery; there was no accessible spot which was not barred by intrenchments provided with fraises, palisades, chevaux de frise, or abatis; and, lastly, there was no opening which was not manned by troops and bristling with bayonets.'

The 'Mémoires de Masséna' give the following details:—

Monte Nafari, the extreme and most elevated point on the right, was protected by 2 redoubts, one of which was armed with 4 guns and a howitzer and the other with 2 guns and a howitzer, and by 2 *flèches*, in the interval between which ditches had been excavated.

Starting thence was a series of redoubts and *flèches*,¹ armed with from 2 to 5 guns; the last of them rested on the Adige.

The extent of the position was 7,655 yds. In front of the centre and on the right of the road from Verona to Vicenza lay the village of Caldiero.

The Archduke's Army numbered 50,000; that of Masséna was not quite so strong.

The Austrians, resolved to dispute every foot of the ground, encamped in front of their line of defence.

On October 29 Masséna drove them back from Verona to the foot of the hill. After a sanguinary conflict Caldiero remained in the hands of the French, but they evacuated it at nightfall, so as to renew the attack on the following day under more favourable circumstances.

On the 30th Masséna resolved to break the Austrian centre with the bulk of his forces while Verdier crossed the Adige and fell on their left flank.

¹ Mathieu Dumas' plans show twelve redoubts along the whole line. There were in addition a church and several houses with loop-holes.

The former attack was successful, but the latter failed for want of means of crossing.

In the centre the Austrians were forced back behind their intrenchments.

Molitor, who was ordered to make a demonstration against their right, suffered severely from the artillery of the redoubts. Nevertheless he captured some of them, taking advantage of the recoil of the guns to enter the embrasures. But being attacked in front by the garrisons of the works, and at the same time in flank by the columns which issued from between them, he was obliged to retreat, after having sustained considerable losses.

The centre attack, owing to the intrenchments constructed behind Caldiero, made no progress, and the day came to an end without any decisive result having been arrived at. 'The Austrians,' says Mathieu Dumas, 'manœuvring and fighting in front of and between the redoubts, had preserved their intrenched position intact; the French had repulsed, beaten, and dispersed their columns, and had forced them to retire in disorder behind their lines.'

On the following morning, Verdier, having succeeded in crossing the Adige, advanced towards Caldiero; the Austrians marched to meet him, and prevented for the whole day the junction of his division with that of Duhesme, which had formed the right of the French in the attack of the 30th.

While the Archduke was endeavouring to sustain this lingering fight on his left and centre, he carried out, unknown to Masséna, the first operations of his retreat, which had been rendered necessary by the disasters of the Army in Germany and by the necessity of covering Hungary.

The intrenchments of Caldiero, then, enabled Archduke Charles to retire safe and sound after having disputed the ground foot by foot for three days.

These intrenchments have a great similarity to those raised by Marshal Soult in 1814 on Mont Rave, at Toulouse, which also rendered him great service.

IV. BORODINO.

This was a battle between 127,000 French under Napoleon and 121,000 Russians under Kutusow.

The Russian Army, which had been in position for two days, had constructed in the centre of its front line a large bastioned battery,¹ open at the gorge, and armed with 21 heavy guns. On the left of this battery was the burnt-down village of Semenofskoï, in front of which the Russians had constructed 3 *flèches*. At a distance of 2,187 yds. from these *flèches*, on a hill, there was a square redoubt, armed with 12 guns. The extreme left rested on wooded heights.

On the right of the bastioned battery epaulments had been constructed to defend the approaches of the village of Gorke.

Between this village and the large battery, 1,640 yds. in advance of the front of the position, was the village of Borodino, which was occupied by 3 battalions of the Russian Guards.

The extreme right was protected by 3 *flèches* and by a line of abatis surrounding the wooded height on which this wing rested.

The advanced redoubt of Schwardino, constructed in front of the left centre, was attacked on the eve of the battle by the division of General Compans, who made himself master of it after an obstinate struggle. Twice this brave division had to fall back, and it was only after the third assault that it succeeded in keeping its ground.

On the following day, September 7, the 3 *flèches* in front of the left centre gave rise to a sanguinary conflict. Marshal Ney, supported by Murat, carried them only at the cost of enormous sacrifices.

Still more remarkable was the part taken by the large battery in the centre.

Serving as a pivot and a support to the left wing of the

¹ It consisted of a long line having a bend at each end and a bastion in the centre.

Russians, it prevented the Duke of Elchingen from piercing the line on that side.

Deeming that it must be carried at any price to overcome the resistance of Kutusow, Napoleon had it attacked in front by Prince Eugène, while the 2nd Cavalry Corps outflanked it right and left.

The battery was taken in reverse by the heavy Cavalry, which cut its heroic defenders in pieces, just as the 9th Regiment of the Line reached it in front.

From that time the battle was won.

If the gorge of the battery had been closed the attack would probably have failed.

CHAPTER VI.

REDOUBTS AND BATTERIES.

THE construction of redoubts and batteries gives rise to some difficulties to which it is important to draw the reader's attention.

When the redoubts have to be constructed quickly, only a small command can be given to them, and in this case the extent of their action on the surrounding country is small. It is also considered advisable so to regulate the work that the profile may be gradually strengthened up to the time when they come into action.

To increase their powers of resistance their ditches are made deep, rather than wide. However, it is well not to exceed 9' 2", because below that depth men cannot throw the earth with their shovels on to the edge of the ditch. Then it has to be thrown up half-way and passed on (*remanier*), an operation which causes a loss of time and requires an extra number of diggers.

To prevent the defacement of the escarp, and consequently of the exterior slope, a berm of about a foot is left at the base of the latter. On this berm stand the men detailed to pass on the earth and form the exterior slope. If it were wider, it would afford the attacking troops a place to rest and rally, which would be prejudicial to the defence. When the work is completed, this berm may be got rid of by prolonging the exterior slope till it joins the escarp. A few blows with a shovel are enough to effect this.

If the redoubts are to be armed with guns, no greater com-

FIG. 2.

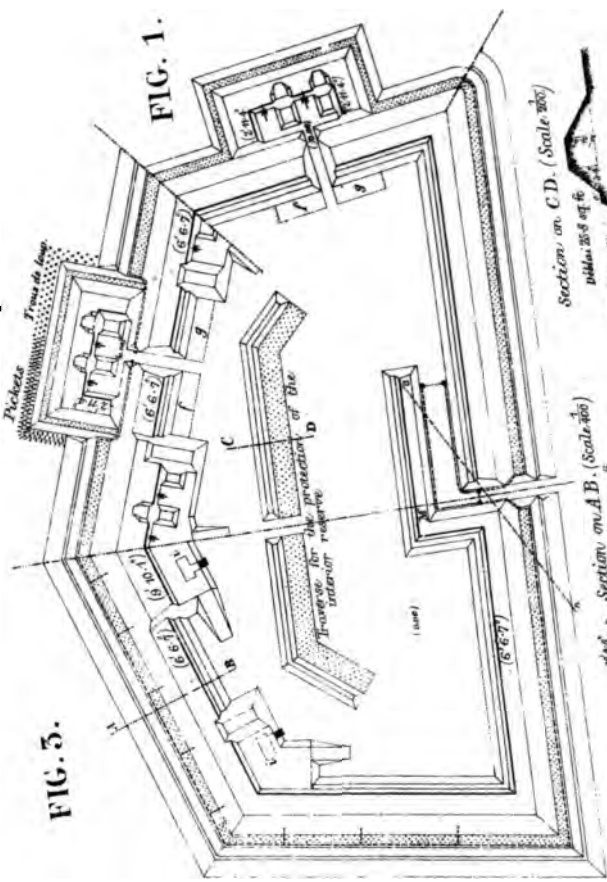
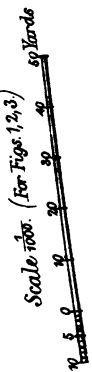


FIG. 3.

N.B. The dimensions shown in brackets are the heights above the level of the ground.

FIG. 4. (Scale 50)



mand over the country than 2' 11·8" can be given them, unless barbettes and platforms are constructed.

This consideration, together with the impossibility of posting a large number of guns in closed works, has induced Rogniat and other Engineers to place the Artillery behind epaulments in the spaces between the redoubts.

We have explained above the reasons which oblige this rule to be sometimes departed from, as, for example, in the construction of closed works protecting the flanks of villages, or sweeping an important approach, road, embankment, or defile by which the enemy can issue on to the front of the position.

In this case it is advisable to post the artillery in such a way that it may come into action as soon as possible, without hindering the working-parties detailed to gradually strengthen the profile of the redoubts.

To attain this object we propose to advance the batteries in front of the tracing, and to make the parapet in rear of them continuous, with the exception of an opening left for the guns to enter through. In this way the Artillery will be able to fire up till the moment when the platforms are in readiness to receive the guns, which have been temporarily posted in the low batteries. As soon as the latter are disarmed, the Infantry take possession of them, and they then form regular flanking *canonnières*.

The right-hand side of Pl. 5 represents a redoubt of this kind, Fig. 1 showing the first arrangement, and Fig. 2 the final one. This appears to us to be preferable to the arrangement in Fig. 3, which is the one in general use. However, the profile of the latter has the advantage of being equally strong throughout, whilst that of the former is very weak where the batteries are. To remedy this defect we must place in front of them pickets joined together by wire, crows' feet, harrows, *trous de loup*, and other auxiliary defences which do not interfere with the fire of the Artillery.

It must be noted also that the above-mentioned arrangement

is not applicable to redoubts with sides less than $43\frac{1}{2}$ yards long.

To finish the parts of the parapet lying behind the low batteries excavations *f, g, f, g* (similar to those represented in the section on *CD*, Pl. 5) should be made at the bottom of the slope of the banquette.

When trees fit for forming abatis can be procured on the spot, it will be found advantageous to substitute the profile in Fig. 2, Pl. 6, for that shown in the section on *AB*, Pl. 5; if necessary, the abatis on the berm can be replaced by fraises, that is to say, by a line of palisades having an inclination of about $\frac{1}{1\frac{1}{2}}$ towards the bottom of the ditch.

The profile in Fig. 3, Pl. 6, shows another use of abatis. As in the last-mentioned profile the trees are protected by a glacis, which shelters them from fire. This precaution is, however, not indispensable, experience having proved that artillery produces little effect against felled trees, especially when the trunks and branches are joined by wire.

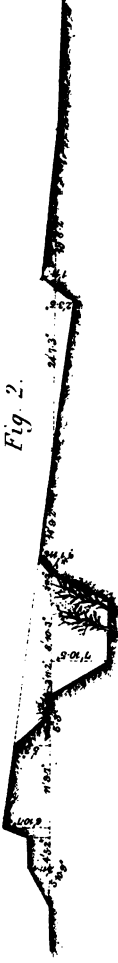
Fig. 4, Pl. 6, shows a judicious application of trous de loup and pickets for the defence of intrenchments.

The garrisons of redoubts are calculated at the rate of two men to every lineal mètre ($3\frac{1}{4}$ feet) of parapet.

The interior reserve, which is comprised in this estimate, remains behind a covering mass, to which we propose to give the profile shown by the section *CD* (Pl. 5). This profile has the advantage that it has three banquettes, *e, f, g*, on two of which the men can sit without being exposed to the enemy's shots.

To accelerate the work and give still better cover to the interior reserve, the excavation intended for it might be constructed at the bottom of the slope of the banquette. However, in that case, the defenders would not be so well placed for repulsing the hostile troops when they stormed the work.

The magazines in the redoubts are placed under the terreplein of the barbettes (see *i, i*, Fig. 3, Pl. 5), or under traverses



Section on C D.



Section on a b.



Section on A B.

Fig. 6.

Scale 250. (For Figs. 1, 2, 3, 4, 5)



Brialmont, *Rasty Intrenchments.*

Henry S. King & Co. 68 Abchurch Lane, London.



formed in the blindage for the reserve. They are generally 8' 6.4" long, 5' 3" wide, and 6' 6.7" high, these dimensions being sufficient to shelter the ammunition for 3 guns. Their covering, whether formed of earth or of timber, must be sufficient to resist the concussion and explosion of shells.

When time allows, palisades are placed in the ditch of the redoubt. In order that they may be protected from the enemy's fire they are fixed near the counterscarp, and are covered by means of a glacis. (See Pl. 5, section on *A B*.)

It is also useful to place some lines of palisades across the ditch to prevent the enemy, when he has reached it, from attacking the redoubts at several points at a time. On the other hand, by obliging him to remain massed for some time in a narrow space, we increase the danger resulting to him from the explosion of shells or hand grenades.

The entrance to the redoubt is on the least exposed side. It is from 6' 6" to 13' in width, according as it is intended for the use of Artillery alone, or of both Artillery and Infantry.

The ditch is crossed either by an embankment or by a spar bridge, formed of trunks of trees supported at the ends on the ground and in the middle by a wooden trestle. These trees are covered over with planks or fascines.

Entrances which are exposed to direct fire are protected by traverses of earth, and others by stockades, behind which a banquette is placed.

The opening between the traverses and the parapets is closed by means of chevaux de frise, railings, or house doors.

In redoubts intended for the reception of Artillery the space between the traverse and the parapet must be broad enough to allow a gun to turn. As this condition is difficult to fulfil in a small work, on account of the great length required by the traverse when placed at any distance from the entrance (see the line *n o*, Pl. 5), an opening is left at *M* for the guns to pass through, which is afterwards closed by sandbags or by any other means at hand.

The gorges of open works likewise require some precautionary measures.

We recommend that they should be protected by means of trous de loup, abatis, stockades, or wire network, so as to shelter them from attacks in reverse, and, above all, to give their defenders some security at night and in foggy weather.

If the large battery constructed by the Russians at Borodino had been protected in this way it would not have been carried by a charge of cuirassiers.

Shelter constructed for Artillery has given rise to several objections.

It is stated that guns behind epaulments are too much tied to the spot, and that the loss becomes too severe as soon as the enemy has succeeded in directing his fire well.

There is no ground for this objection. A battery entirely uncovered, exposed to a well-directed fire from a hostile battery, must necessarily suffer greater losses than one firing from behind an epaulment 2' 11" 4" high.

It is true that in an open country the guns are advanced or retired as soon as the enemy's fire becomes very accurate, but what is to prevent the same being done when the Artillery is placed in the first instance under cover?

Besides, the batteries often occupy positions which are strictly determined by the nature of the ground; in that case they cannot be moved about, and the epaulment acquires an incontestable utility.

When the positions are not of this character, the covering mass is of use up to the moment when the enemy's fire becomes very accurate.

We must add that the operation of limbering up and unlimbering requires easy ground, and always causes great loss of time. In fact, it is not sufficient to replace the guns in a battery, but new shelter must also be found for the waggons and limbers.

From this point of view one of the great advantages of rifled artillery is that it compels the batteries to make fewer moves.

The following objection is more serious:—

Explosive projectiles which strike the crest of the epaulment between two guns, burst there, and are consequently dangerous. If there were no epaulment these same projectiles would pass between the guns and would burst only on reaching the ground, so that the danger would be less.

But the disadvantage of the epaulment in this respect is more than compensated for by the very effectual protection it ensures to the guns in the first moments of the fight. It has in fact been proved at Vienna, by firing against a battery similar to those at Sadowa, that 49 per cent. of the projectiles are stopped by the covering mass.¹

In flat and open places the batteries must be completed by shelter behind which may be placed, at easy distance, the gunlimbers and the small parties of Cavalry which serve as supports for them.

Formerly the batteries had the profile shown dotted in Fig. 12, Pl. 2. The detachments were then under cover from direct fire when they retired behind the guns after loading.

The profile shown in the section on *o p*, Fig. 9, Pl. 2, requires much less work and affords the same protection to the detachments when they stand beside the guns in the trenches constructed for this purpose.

If the battery have merlons, the detachments are covered up to a height of 4' 11" close to the guns and up to 7' 10.5" in the trenches.

Another advantage of these trenches and of the merlons is that they allow of small expense magazines being constructed, which facilitate the serving of the guns and diminish the risk of explosion during the transport of the ammunition across country. Owing to these magazines the limbers may be placed at greater

¹ This result was obtained on 240 shots.

distance from the batteries, and we can thus profit by the artificial or natural cover to keep them out of the enemy's sight and safe from his fire.

Some artillerymen condemn the merlons because they limit the space the guns can fire over, and facilitate the laying of the enemy's guns.

These drawbacks may be remedied by placing the guns farther apart,¹ and by masking the embrasures by means of branches of trees. At Sadowa a battery of the 10th Corps completely hid its guns from sight by means of branches of trees planted on the parapet.

'One other battery,' says Colonel de Pidoll, 'and the shelter for riflemen constructed beside it, were so well masked by shrubs on the parapet, that, although I knew their position perfectly, I approached them within twenty or thirty paces without noticing them.'

Besides, when the merlons interfere with the fire they can be cut down, either altogether or partially, in the space of a few minutes.

Those who ask for the abolition of merlons take into consideration direct fire only; now, a battery is often exposed to oblique fire, in which case the merlons provide the detachment with cover to a height of 4' 11". They are very useful, too, against the skirmishers who take the guns in flank while the Artillery attack them in front.

The trenches between the guns should be made with an inclination to the rear, ending at a cask or gabion (which serves as a well) buried in the ground, and covered with planks or hurdles.

Colonel de Pidoll says that batteries similar to those at Sadowa (see Pl. 1, Fig. 8) may be constructed in easy soil in three or four hours by 160 Infantry, and a party of Engineers or Artillery

¹ Behind a straight parapet the guns have a maximum lateral range of 60°. This can also be obtained with merlons placed at suitable distances and properly shaped.

(to superintend the work), each man excavating from $15\frac{3}{4}$ to $20\frac{1}{2}$ cubic feet per hour.

The seven batteries at Salney were constructed by a battalion of the 1st Regiment of Engineers, half of whom arrived at noon, and the other half at 4 P.M. on June 29. In the morning of June 30 all these batteries were finished, and ready to open fire.

At Sadowa the same battalion constructed four batteries on the morning of July 2. Two were finished in three hours, in spite of the roots of trees, which retarded the excavation.

During the engineering operations which took place at Vienna in 1867, similar batteries were constructed in two and a half, and even in two hours, by increasing the number of workmen, and imposing on each man a task of $31\frac{1}{2}$ cubic feet per hour.¹

Colonel de Pidoll informs us that out of ten commanders of batteries who made use of the epaulments (at Salney and Sadowa) described above, two found that these batteries possessed *special merit*, six reported them *good*, and two *pronounced against their use*.

Four out of the ten commanders declared that, after several hours' fighting, they had not lost a single man; the others complained only of insignificant losses.

¹ *Mittheilungen über Gegenstände der Ingenieur- und Kriegswissenschaften*, 1869. 178 men constructed a battery for 8 guns in $2\frac{1}{2}$ hours. 210 men constructed the same battery in 2 hours.

CHAPTER VII.

FORTIFIED VILLAGES.

AN Army intrenches a small town, a village, or an isolated building for one of the following reasons :—

1st. *To protect a detached post*, by which is meant any post situated on the front or flank of a position beyond range of Artillery, and serving either to extend the action of the Army, to give notice of the enemy's approach, to check him for some time, or to dispute an important communication.

The mill of Boussu, 4,263 yards from the position at Jemmapes; the village of Arcola, in rear of the left flank of the position of the same name; that of Vago, in front of the position at Caldiero; that of Wichau, in front of the position which the French Army occupied between Brünn and Austerlitz; and the Schwardino redoubt, constructed by the Russians in front of the left centre of the position of the Moscowa, to serve as a support for their advanced guard—all belong to this description of posts.

2nd. *To protect an advanced post*, by which is meant a post established a few hundred yards from the front or flanks of a position, from which it receives effectual protection. Such posts serve to prevent the enemy's reconnaissances, to delay his first attacks, and to threaten the flanks of the columns which attempt to pass them. The village of Neerwinden, in front of the right wing of the Austrians, in 1793; the village of Borodino, in front of the Russian centre at the Moscowa; the village of Ailles and the farm of Heurtebize, in front of the position at

Craonne; the farms of Hougomont and La Haie-Sainte, in front of Wellington's right and centre at Waterloo—are all posts of this kind.

3rd. *To support the front or flanks of a line of battle.*

History offers a large number of examples of posts of this kind, which we will call tactical pivots, or 'included posts' (*postes intercalés*), because they form part of the front of the position.¹

Among the most remarkable we may mention the village of Oberwinden, included in the left wing of the Austrians at Neerwinden; the villages of Telnitz and Sokolnitz, in front of the French right at Austerlitz; those of Esslingen and Aspern, at the battle of Esslingen; the village of La Rothière, enclosed in the centre of the French Army at the battle of that name; and the villages of Ligny and Saint-Amand, at the battle of Ligny.

4th. Towns, villages, and isolated buildings are also fortified under the same circumstances in which closed works, abandoned to their own resources, are constructed, either to defend a line of operations, to protect the stores of food, arms, or ammunition on the flanks of an Army, to place troops in camp beyond reach of a surprise, or lastly, to guard a bridge and to keep open for oneself the means of issuing from it in presence of the enemy.

We will occupy ourselves specially with villages intended to serve as advanced posts or as tactical pivots in a line of battle.

Such villages played such an important part in the wars of the 17th and 18th centuries that a position was not considered good unless it had some on its front and flanks.

Frederick II. was one of the first who discarded this custom. One of his generals said²:—'We have got rid of the idea that in a battle it was an advantage to await the encounter when the villages were in front or in the first line; they were crowded

¹ The difference between these and advanced posts is often very trifling.

² Warnery—*Remarques sur la Cavalerie*, written in 1763.

with Infantry, and were hastily fortified ; they were obstinately defended up to the very last, and, when they were lost, so was the battle. Neerwinden furnishes us with an example of this ; at Ramillies, as soon as the French Infantry was dislodged from the village the Cavalry was able to come into action, and the affair was soon over. At Kesselsdorf it was the same. In the last war in the Netherlands the battles of Count de Saxe were won by taking a few villages.'

We read in the *Principes Généraux de la Guerre*¹, by Frederick II. :—'Our principles being to attack, and not to defend ourselves, we need only arm posts of this kind (country-houses and churchyards) when they are in the front or before the wings ; they cover the attack of our troops, and are very troublesome to the enemy during the battle.'

This too sweeping assertion is explained by the fact that the villages in the countries adjoining Prussia 'were of wood, and badly built ;' so that, as Frederick himself says, to attack them with howitzers was enough to set fire to them, and to force the troops to evacuate them.

Among the battles of that time which prove the utility of intrenched villages we may mention that of Breslau, which was won in 1757 by 80,000 Austrians under the command of Charles of Lorraine, against 30,000 Prussians under the orders of the Duke de Bevern. These latter defended the ground foot by foot, from daybreak till nightfall, owing to the support they received from the fortified villages of Pilsnitz, Schmidfeld, and Höfchen, situated in front of their line of battle. The defenders of Pilsnitz repulsed three attacks of the left wing of the Austrians. They subsequently, under cover of darkness, evacuated the village, because they had no longer any reason for remaining there ; the battle was really lost, but the victory of the Austrians was so far from decisive that the two Armies remained on the following day in presence of each other.

¹ *Œuvres de Frédéric le Grand*, vol. xxviii.

Since the Seven Years' War there have been a hundred opportunities of establishing the fact that villages well chosen and well manned can be of immense use, even without being fortified; for instance:—Neerwinden, Austerlitz, Raab, Aspern, Wagram, Gros Görchen, Leipzig, Arcis-sur-Aube, La Rothière, Ligny, and Waterloo.

Besides, Frederick II., as we remarked at the beginning of this treatise, never despised the use of fortifications to increase the resistance of defensive positions.

The camps of Neudorf (1741), Czaslau (1742), and Schweidnitz (1745) are a proof of this.

He says, in his *Pensées et Règles Générales pour la Guerre*—‘The enemy who wishes to avoid fighting seeks to derive advantage from a difficult country . . . constructs batteries . . . protects himself with chevaux de frise, redoubts, and intrenchments.’

Frederick blamed only the abuse of fortifications, and in this respect he cannot be reproached. Indeed this abuse, which proceeds from too great a mistrust in the offensive power of troops, is at least as dangerous as the contrary abuse, which arises from excessive temerity.

An Army which at the present day despised the aid of shovel and pickaxe would sustain immense losses, and one which remained immovable behind fortifications ‘would,’ as M. Vial says, ‘see the enemy marching out of range so as to come and attack it either on the flank or in rear.’

Fortified villages are above all useful as advanced posts of the defensive front. On the offensive front they are less so, and sometimes even hurtful. They impede the movements of the troops, and provide for the enemy, when he has taken them, excellent tactical points, from which it is difficult to dislodge him, and which enable him to restore order to his shaken columns.

To protect a weak point or to sweep an undulation of the ground, an isolated building (farm-house or château) is often preferable to the best village. The putting of such a building in a state of defence requires little time and few troops, and the

enemy is obliged to make himself master of it, just as much as of a fortified village, before approaching the line of battle. The farm of Kismegyer, situated in front of the centre of the Austrian Army at Raab, was extremely useful to them ; it consisted of a large square building, the walls of which had been loopholed, and in which 1,200 men were posted. General Seras, having attacked it with Infantry alone, was repulsed by a well-directed musketry fire. He renewed the assault after having received reinforcements, and this time he penetrated into the farm-house, though he left from 700 to 800 soldiers and 60 officers on the ground.

Just as obstinate was the struggle occasioned by the taking of the sheep-farm of Avenhayn, which was situated in front of the Allies' left centre at the battle of Wachau under the walls of Leipzig.

At Waterloo the English Army derived great advantage from the farm of La Haie-Sainte, although it was occupied only by a battalion of 430 men.

In spite of these remarkable facts, we think that in many cases a redoubt armed with guns will be of more use than a fortified farm-house or château.

The commanders of Armies will not again have the good luck of the Duke of Wellington in being attacked by generals who omitted to employ Artillery for destroying the advanced posts of the line of battle. The mistake made by Seras in the attack of the farm of Kismegyer, and by Guillemillot, Jérôme, Reille, and Guiot in the attack of the farms of Hougomont and La Haie-Sainte, has been too often pointed out for it to be committed again. In future, when a farm-house or château hinders an assailant in his advance or attack it will be at once demolished by the fire of some rifled batteries.

This is no reason for condemning this kind of posts ; but only for trusting less to them, and, above all, for not making the issue of a battle depend upon their occupation.

The art of intrenching isolated buildings will always be of use for organising *réduits* in villages or forming posts of support in positions which Artillery can attack neither at long nor short range, as is sometimes the case in mountainous countries.

Woods, farm-houses, and villages situated on the front of the line of battle which are not to be occupied must be burnt or otherwise destroyed, if it be proved that the enemy might derive advantage from them.

The nature and importance of the works to be constructed for the defence of villages vary according to circumstances and places.

Villages may be classed under three heads.

The first comprises those in which detached posts are established, which have to resist with their own forces, either as long as possible or else only until assistance can be given them. Under this head come villages which contain stores of provisions or ammunition, those which form the exterior line of a cantonment or winter quarter, and those which shelter posts of observation on the front or flanks of an Army.

Under the second head come villages situated in advance of a line of battle or included in it.

Under the third head are villages on which the wings of an Army rest.

I. ISOLATED VILLAGES.

In the case of these there is usually some disproportion between their circumference and the number of troops charged with their defence.

If so, we must limit ourselves to occupying strongly a well-placed group of houses, a *château*, a church, a factory, or a large farm-house, whence the principal approaches can be seen.

As far as possible we must avoid occupying villages placed in hollows, and those which contain wooden houses or thatched roofs.

The works to be executed for the defence of isolated villages are as follows :—

To demolish or burn the houses which interfere with the defence of the group or single building which has been chosen, and to barricade all the approaches which are not required to facilitate the retreat of the outposts and the arrival of help.¹

During the execution of this work the part to be occupied is put in a state of defence, the instructions given further on being adhered to.

If the detached post be sufficiently important for the whole village to be defended, it should be organised as if it were situated in front of a line of battle, with this difference—that as the attack is not limited to a part of the circumference, the intrenchments will have to surround the whole place.

II. VILLAGES ON THE FRONT OF A LINE OF BATTLE.

There is generally but short time for fortifying villages of this class.

So as not to be taken unawares, the part facing the enemy should first be intrenched, by destroying the bridges and fords, and by blocking the principal approaches by means of overturned carriages, harrows, beams, casks, heaps of paving-stones, and other incumbrances.

If the enemy does not come upon us immediately we can complete these defences by forming abatis, constructing epaulments in the positions favourable for Artillery, and barring the roads by means of ditches and parapets. These parapets, in the important passages, will be made indented, so as not to interrupt our communications with the country. They should be flanked by means of riflemen posted in the neighbouring houses. Sometimes several of these barricades may be constructed one behind the other, in order to dispute the ground foot by foot, and to prevent the projectiles from ricocheting.

¹ The roads by which assistance arrives are generally those which have to be used for the retreat.

The sides of the village should be defended in the same way as the front.

The back part alone should remain open, and all obstacles should be destroyed on this side which could interfere with the action of troops who might afterwards be ordered to retake the village.

Roads leading to the front of the position should be swept by the intrenchments or the batteries of the first line of battle, if the village be *advanced*, and by those of the second line if it be *included*.

The reserves should occupy the market, the places where roads meet, and, in general, the places best adapted to arresting the enemy's advance, and to supporting and rallying the troops defending the circumference.

When the enemy can reach them they should get under cover from his fire in trenches provided with steps, which they could leave quickly when necessary.

We may frequently be obliged to open communications between these reserves and those points of the circumference or interior to which they are to repair in case of attack.

As it is a rule that the skirmishers and posts of support established in the outskirts of the village should retire without masking the fire of the reserves, the roads or streets leading to these reserves should be barricaded, and indirect roads should be formed through hedges and walls, by which the retreat of the outposts may be effected so much the more easily that the enemy is ignorant of them.

In most cases a fortified *réduit* would be assigned to the reserve, whence it can sweep the principal streets. This might be sometimes a church, sometimes a *château*, a factory, or a strong isolated house. In the courtyard or in the side of the building would be placed, if there were no reason against it, some light guns to sweep the principal approach.

If there be still time to spare, we should construct in the outskirts of the village continuous lines of obstacles, or (when

the circumference is too great) works at intervals, flanking one another and covering the principal approaches to the position.

If within musketry range of the enceinte there were a hollow road, parallel to the village, the side of it would have to be sloped in such a way that it would be exposed to view.

Embanked roads which cross the position should be enfiladed or stopped up.

Quickset hedges and enclosures made of planks may be utilised as exterior revetments of parapets.

As for enclosure walls, instead of piercing them with loop-holes, which requires skilled workmen and special tools, men can fire over them by supporting against them a banquette of earth or planks.

At all times we should avoid posting Artillery behind walls when it is exposed to Artillery fire.

While these works are being executed part of the troops can prepare the most important houses of the enceinte, and those which have to serve as a support for the street barricades, for taking part in an obstinate defence ; another part can strengthen the réduit, and open communications between it and the detached works.

If the village be on the offensive front, we must keep open or else make wide roads of communication to assist in the advance of the troops.

It may often be advantageous to replace the réduit by a redoubt, with or without a blockhouse. This will indeed always be the case when the enemy can attack the réduit with Artillery.

As a matter of course, under these circumstances only part of the reserve would occupy the réduit ; the rest would remain at hand, sheltering themselves as much as possible behind natural obstacles or in the trenches. Sometimes epaulments may be constructed on the sides and in rear of the village to cover the detachments of Cavalry detailed to attack the hostile forces in flank.

III. VILLAGES SITUATED ON THE FLANKS OF FIELDS OF BATTLE.

The same precautions must be taken as in the last case, *i.e.* that the defence is so organized that the village cannot be turned. To attain this object, redoubts armed with guns of long range, and shaped with a bend to the rear, should be constructed on the threatened flank.

The rear of the village will, in addition, be fortified to protect it against an attack in reverse.

It forms no part of our plan to point out the most suitable and most expeditious means of organising the exterior defence of villages and redoubts. On this head we will make only a single remark.

Engineers recommend the use of the following methods :—

To destroy the bridges and obstruct, by means of barricades or abatis, all the paths which can be of use to the enemy ; then to prepare for defence the houses lying between these paths ; to make loop-holes in the walls which look over the country, and especially in those which, on account of their projecting, act as flanks ; to barricade strongly the doors and windows on the ground floor ; to form dams in streams of water, which may be useful for inundations ; to strengthen the vulnerable points of the enceinte by abatis or palisades ; in short, to destroy as far as possible everything that can afford cover for the enemy or interfere with the defence.

The abatis, wire network, palisades, outlying houses, hedges, ditches, and enclosures form what it has been agreed upon to call the *outer enceinte*.

This enceinte is occupied by skirmishers and strengthened by posts of support. In rear are placed the reserves, supported by one or more *réduits*.

Among the directions we have just given there are some which could not be executed properly and at the right moment unless a detachment of Engineers with a waggon full of tools

were attached to each battalion. One of these directions is that which lays down that the outer walls of the village should be loopholed to form the first defensive enceinte. This rule has, however, lost its importance since the introduction of rifled guns. The explosive projectiles of these guns cause indeed such great destruction in the interior of buildings that it would be impossible to keep troops there after a few shots. It is only in the exceptional case of an attack made without the help of Artillery that we could recommend the putting in a state of defence of the buildings situated in the outskirts of the village. It might also be done if large enclosures surrounded by thick walls were in question, as, for instance, la Bergerie, the park of St. Cloud, the château of Bougival and le Haras, in the Prussian line of defence between St. Cloud and Bougival, occupied by the 5th Corps. Then, behind these enclosures trenches or blindages are constructed, into which the defenders retire during the cannonading to sally out at the moment of attack.

We are of opinion that the best outlying fortifications (except in the exceptional cases above mentioned) are those composed of continuous intrenchments, when the post is not too extensive, or of detached works, joined by abatis and trenches, when the length of the circumference is considerable.

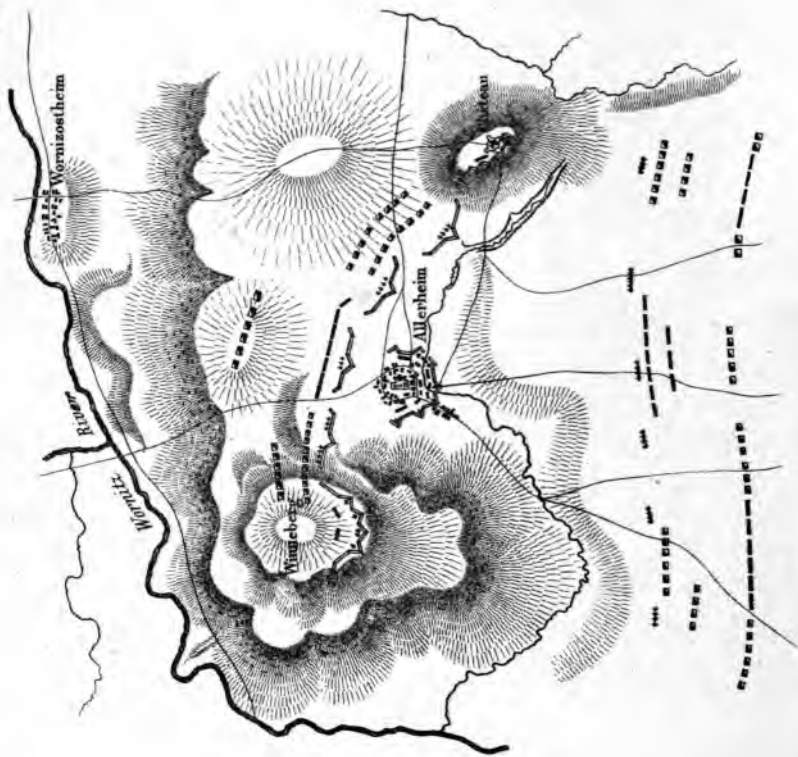
In rear of these defences, and especially in the streets which the hostile columns must pass through to reach the réduit, it would be as well to occupy a few houses strongly, from which so much the more advantage would be derived that the enemy's guns could not reach them from a distance.

The battle of Allerheim in 1645 (see Pl. 7) furnishes us with an example of this kind of defence.

The château of Allerheim was occupied by 2 battalions and 3 guns, and the fortified village of the same name by 7 battalions and 6 guns.

The latter was attacked by 3 battalions under the command of General Marsin. These battalions crossed the intrenchments, and reached the centre of the village, where they were exposed





to a well-sustained fire from buildings occupied by Bavarians. Decimated by this fire and vigorously attacked by the reinforcements sent to this point by Mercy, they were obliged to fall back. Condé immediately advanced the rest of the Infantry of his centre and renewed the attack with fresh ardour. He lost all his aides-de-camp in this deadly encounter, and was himself wounded. Almost at the same instant Mercy fell, struck by a musket ball.

On hearing of his death the Bavarians retired from the village; only the troops posted in the stone houses and the church continued to defend themselves with rare energy.

The fight was undecided at this point until a brilliant attack of Condé's left wing forced the Bavarian Army to retire. Immediately the Weimar and Hesse troops, who composed that wing, threw themselves on the right flank and rear of the village, and forced its defenders to lay down their arms.

This example bears witness in favour of the mode of defence which we recommend, and which consists in protecting the enceinte of villages by means of intrenchments, and the interior by means of loop-holed buildings.

When these buildings, intended to serve as points of support for the reserves, or as réduits for the defence, can be attacked by Artillery, or when they are not sufficiently important or well placed to be suitably intrenched, it is prudent to give them up and to replace them by one or more redoubts.

In support of this opinion we may quote the following remarks made by Napoleon as to the attack on Allerheim:—'It is not to be wondered at that without howitzers and with so few guns Condé failed in all his attacks on this village, which was supported by the line of battle 213 yards off, the houses of which, as well as the church and churchyard, were loopholed, and which was defended by Infantry, superior not only in numbers, but also in quality. But for Mercy's death the field of battle would have remained in the hands of the Bavarians.'

As a general principle, we are in favour of the employment

of earth as a covering mass in the defence of villages. Among subsidiary means we recommend hedges (behind which parapets are raised), enclosures of palisades, abatis, and wire network.

If the village have long streets by which the enemy is forced to advance, they should be barricaded, and riflemen should be posted in the adjoining houses, prepared to defend every foot of the ground. The barricades should be constructed in preference in turns of the street, so that they may not be exposed to direct fire. When there is time a ditch should be dug in front of these obstacles, and a banquette should be formed behind them.

If necessary, stone fougasses should be placed in the streets to be followed by the enemy's troops, or, better still, at the points where they are obliged to halt for a time to climb over or level an obstacle, such as abatis, barricades, &c.

Lastly, a *réduit* should be formed, either of a cluster of houses or of one or more strong and well-placed buildings; but in preference this part should be assigned to redoubts, which are less dangerous to their defenders than stone buildings, and almost invariably better situated, because they are specially constructed at the most suitable points for checking the enemy, for favouring the rallying of the outposts, and for ensuring the evacuation of the village.

It is generally admitted that the defence of a village requires 1 man per lineal mètre ($3\frac{1}{4}$ feet) of enceinte. Half the number occupy the outposts, the other half forming the interior reserve. The latter is distributed by zones, when there is a large extent of ground to be defended.

Independently of these troops an *exterior* or *movable reserve* is necessary. For this purpose Cavalry is more suitable than Infantry, because it is more rapid in its movements, and for that very reason can be less numerous.

If only Infantry can be had, the strength of the reserve should be about equal to that of the detachments occupying the village.

The exterior reserve remains under cover as near as possible to the spots where it is to operate. If the village present no

natural shelter in rear of its flanks, it would be well to form some, especially for the Infantry, which is the easiest arm to cover. The Cavalry would in that case remain concealed behind the village, on the side opposite to the point of attack.

It is dangerous to mass many troops in villages, as history proves by more than one example. In 1704, at Hochstädt, Marshal de Tallard had placed 27 battalions and 12 squadrons in the village of Blenheim. These troops, surrounded by Marlborough's army, and decimated by the concentrated fire of his Artillery, were forced to lay down their arms after an indifferent defence.

The villages of La Rothière and Ligny, which were successfully defended in 1814 and 1815, had for their garrison, the former 5,000 men, and the latter 10½ battalions, of which six were in reserve.

When villages are of too great extent they are only partly intrenched, care being taken to destroy or burn any constructions from which the enemy might derive advantage in the attack.

It often happens that along the front of a position are to be found villages composed of one long street.

In that case the rear only is intrenched, care being taken to clear beyond this a sufficient space for the action of musketry.

If the defensive works enclosed also the front of the village, the batteries and defenders of that part would be exposed to being cut off by an attack directed against the flanks, which would necessarily be very long and weak.

To show how the defences of a village should be organised and combined, we will consider two cases :—

1st. A village situated in a plain (those which cover the front of an Army are frequently so).

2nd. A village crossed by a stream of water, and commanded on the enemy's side by dangerous heights (to this class the villages often belong which serve as a support to the flanks of an

Army, and those which form the outer line of a winter quarter or cantonment).

1st Case.

The village to be fortified occupies almost level ground (see Fig. 1, Pl. 9) ; it is of great length in the direction of the road *A*, at right angles to the line of battle.

Between *X* and *Y* the buildings are farther apart ; those situated there should be burnt or demolished, so as to reduce the space to be occupied, and at the same time to form, in advance of the first defences, a bare zone open to the action of musketry and grape.

The road *A*, beyond the point *Y*, should be enfiladed, and the flanks of the little group *YZ* should be swept, by constructing the redoubts 1 and 2. Between these redoubts, a trench with the profile shown shaded in Fig. 4, Pl. 5, should be dug. In the centre of this trench a battery, *g*, of four guns should be constructed, intended to defend the front of the village in conjunction with the Artillery of the two redoubts.

No 1 redoubt enfilades the road *D*, and No. 2 sweeps in a slanting direction the road *C*.

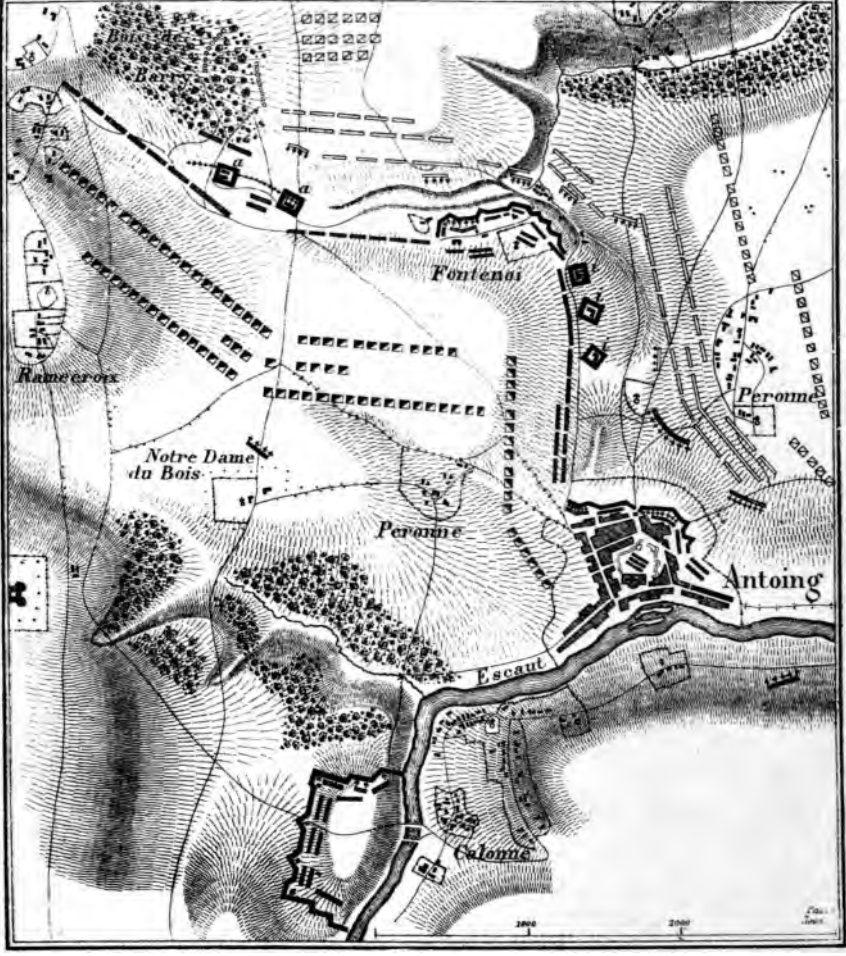
The right flank of the village would be protected by the line of defence 7, 8, 9, an indented trench.

The left flank being covered by a small wood of full grown trees, a line of abatis would be placed there, which would be guarded and defended by riflemen posted in the redoubts 3 and 4. Care must be taken to leave a clear space, at least 100 yards wide, between this line and the inner edge of the wood, to facilitate the movements of troops and the play of the musketry.

The rear of the village would remain open.

However, if there be no redoubts or batteries on the line of battle which effectually protect the flanks and gorge of the village, we should have to construct the redoubts 5 and 6, and throw up at *f* an epaulment to enfilade with three or four guns the road *A*, the principal way out of the village.





These redoubts and battery would form, besides, excellent points of support for the exterior reserve, which is intended to check the enemy at the moment of his trying to leave the village.

Supposing each soldier to excavate $15\frac{1}{4}$ cubic feet of earth per working hour, 4 hours 8 minutes would be wanted to form the trenches in the intervals between the redoubts and on the flanks of the village.

In the same space of time redoubts having the profile of the batteries at Sadowa (Pl. 1, Fig. 8) could be constructed.

Should it be foreseen that we have a whole day at our disposal, we should give the redoubts either the profile *AB*, Pl. 5, or else one of those represented in Figs. 2, 3, and 4, Pl. 6.

To the trenches we should give the profile shown shaded in Fig. 4, Pl. 5, or that represented in Fig. 1, Pl. 6. The excavation of the ditch *efgh* of the profile in Fig. 4, Pl. 5, would take 11 hours 31 minutes, which time could be reduced by one third, and in some cases even by one half, if the workmen be frequently relieved.¹

The profile in Fig. 1, Pl. 6, permits of three men being employed excavating per lineal mètre ($3\frac{1}{4}$ ft.), that is to say:—Two in the trench, which is 25' 11" wide, the one excavating a strip 10' 2" wide, to furnish the earth for the covering mass *X*, the other a strip of 15' 9" to provide the earth for the glacis *Y*, and the third man in the abatis trench, excavating the earth necessary for the mound *Z*. The first would, then, dig up $114\frac{1}{2}$ cubic feet, the second $184\frac{1}{4}$, and the third $98\frac{3}{4}$.

Calculating the time according to the work of the second digger, who has most earth to excavate, and supposing each digger to clear away $15\frac{1}{4}$ cubic feet per hour, about twelve hours are wanted to excavate the profile in Fig. 1, Pl. 6, eight

¹ The dimensions of the profile *abcdefgh* in Fig. 4 are calculated on the supposition that there is no increase. If we suppose that there is an increase of $\frac{1}{10}$, the parapet of the trench will be 5' 5" 8" thick, instead of 5' 3", and that of the intrenchment 4' 4" 4" instead of 3' 3" 4". The same remark applies to the dimensions of the profiles in Pl. 6.

hours if the workmen are frequently relieved, and six hours if they are besides urged on by imminent danger.

In order that the defence of the intrenchments and redoubts which compose the outer enceinte of the village may be effectual, it is necessary that there should be a certain clear space between these works and the mass formed by the houses, hedges, and other enclosures.

Besides, the important condition must be satisfied of not impeding the march of the troops when they are about to take the offensive.

For this purpose the road *A*, which enters the front of the village, should be left clear, and also the road *D*, which enters its right flank.

As for the cross-road *C*, which enters on the left, it may be reached from the outside by going along the line of abatis.

All the streets in the village, with the exception of *A*, *B*, and *D*, should be barricaded.

To reinforce, if necessary, the riflemen occupying the outer enceinte (trenches or field-works), posts of support *a, a, a, a*, should be established in trenches, or behind houses and enclosure walls, situated near the points to which the supports would have to repair in case of attack.

To facilitate the retreat of these detachments, paths should be opened across hedges and enclosures, as shown by the dotted lines. These paths should lead to the spot occupied by the interior reserve.

When the villages are large this reserve is subdivided.

In the case under consideration it would occupy the churchyard *b* and the public square *c*, which adjoins it.

The churchyard walls should be loopholed, and in the left-hand corner two pieces of ordnance should be posted to enfilade part of the road *A*.

The church itself should be made defensible. When it is to be evacuated the troops occupying it would retire by the road

Fig. 2.

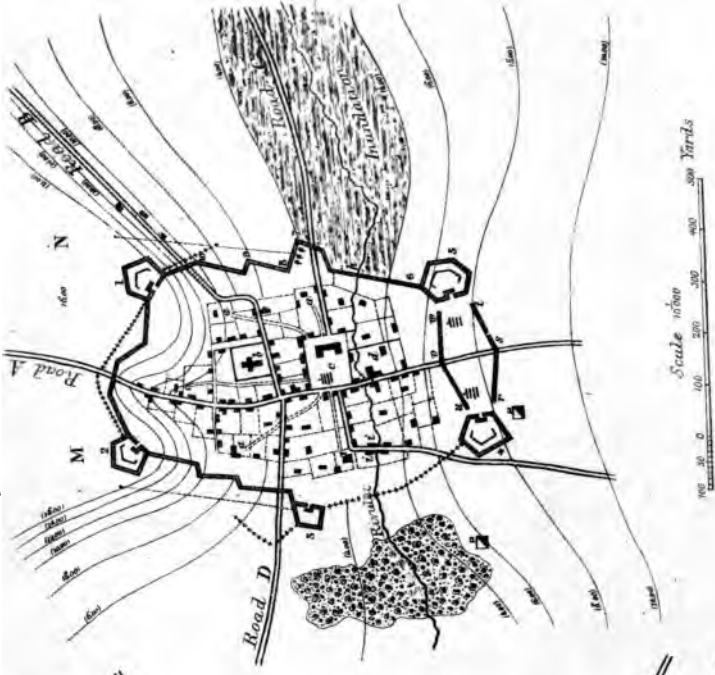
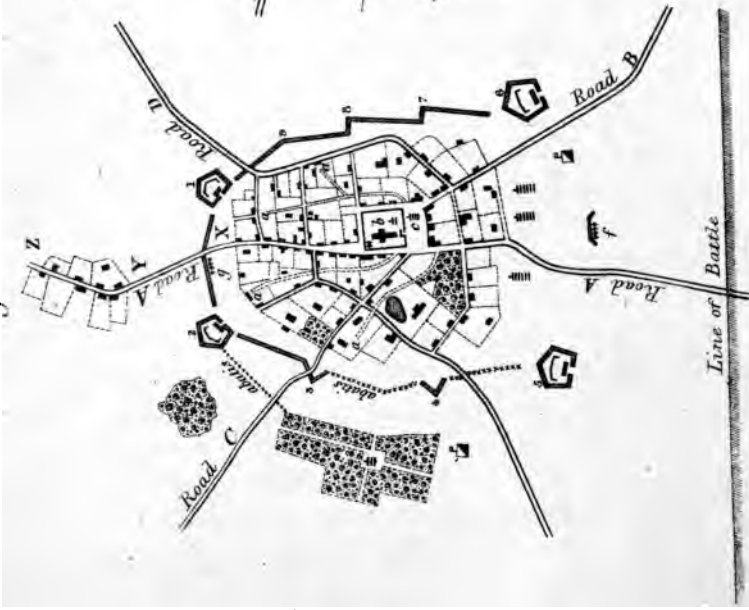


Fig. 1.



N.B. The Contours are shown in Metres (each 32.74)

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B, so as not to mask the fire of the battery *f*, which enfilades the road *A*.

In order to detain the enemy as long as possible in the principal street, the strongest houses should be manned with riflemen, and carriages, harrows, and other articles fit to form barricades quickly should be collected near these houses.

The exterior reserve, composed of three battalions of Infantry and four squadrons of Cavalry, should place one part of its troops behind the village, and the rest behind the little wood. (See the sketch, Fig. 1, Pl. 9.)

When the troops occupying the intrenchments can no longer resist, they would retreat behind the hedges and enclosures which form the outer border of the village, would fire thence with the assistance of the supports (which are intended chiefly to reinforce the line of riflemen), would subsequently retire by the paths across the gardens, and would then join the interior reserve. This latter should defend itself foot by foot with the greatest obstinacy.

The exterior reserve would come up at this juncture, either to repulse the troops about to assault the réduit to arrest the columns leaving the village, or to attack in flank those trying to turn it.

2nd Case.

Let us suppose that a village has to be fortified which is crossed by a stream serving as a line of defence for a winter quarter. (See Fig. 2, Pl. 9.)

The ground beyond the stream rises rapidly up to the plateau *M N*, which commands the space covered by the buildings.

It is evident, at first sight, that this plateau must be occupied to make the defence of the village at all possible.

We should construct the redoubts 1 and 2 there, the faces of which would be so disposed as to sweep the roads *A* and *B*, and the slopes of the ground. The trees bordering these roads should be cut down, and in front of the village a line of abatis should

be placed, the approach to which would be defended by the redoubts and the intrenchments constructed between them.

The right of the village should be covered by an indented trace, 7, 8, 9, 10. The portion of this marked 7, 8 should be armed with three or four guns to sweep the downward slope of the ground on the left of the road *B*.

Starting from the salient 7, the intrenchment crosses the valley of the stream.

A dam constructed at the point *h* would enable us to make the water reach up to the level of four mètres, and to render the road *C* impracticable.

The left of the village would be protected by similar intrenchments.

On account of the importance of the road *D*, and in order to sweep the ground between it and the crest of the plateau to the left of the redoubt 2, another redoubt (3) should be constructed.

To the right and left of this work a line of abatis should be formed with the resources offered by a small wood situated close by. This line should be flanked by the redoubts 3 and 4.

The redoubts 4 and 5, and the intrenchment *r s t*, which joins them, would defend the rear of the village.

Although the part on the other side of the stream is the most exposed, yet on account of the remoteness of the Army, the enemy might perhaps send round one of his columns to the opposite bank, so as to attack the rear while the bulk of his forces advanced against the redoubts 1 and 2.

For this reason the rear must be intrenched as carefully as the sides.

This is not the only difference in the defence of the two villages.

The first one, being in advance of an Army in readiness for battle, must be covered by a line of works with large intervals, to facilitate the marching in and out of the troops; for the same reason the principal streets must be left clear.

A village occupied by a detached post, whose object is to dispute the ground as long as possible, does not require these precautions. The most exposed part would consequently be covered by a continuous line of obstacles, and all the streets would be barricaded; openings would only be left on the side from which assistance might arrive.

The choice of the réduit must be guided by the following considerations.

The church *b* is too near the point of attack to form a good one. The town-hall, situated in the square *c*, would suit better, but the occupation of this building would leave open to the enemy two bridges, which must be disputed to the very last. We should intrench ourselves, therefore, in preference in the factory *d*, which commands one of the bridges, and in the group of houses *i i*, which command the other.

But if, as we must suppose he would, the enemy have Artillery to support his attack, these two posts would not make a long resistance; we should therefore propose to make a stronger and more easily defended réduit by joining the redoubts 4 and 5 by an intrenchment, *u v w*, facing towards the interior of the village.

The reserve consists of $3\frac{1}{2}$ battalions and two squadrons; one battalion should be posted in the public square *c*, to assist and rally the supporting detachments *a, a, a, a* (which would retire by paths formed across the gardens); half a battalion would defend the passage of the stream by loopholing the walls of the factory *d* and of the houses *i i*, and by taking measures to interrupt the communications at a suitable time; the two remaining battalions would occupy the interior of the réduit; and lastly, one of the two squadrons would remain behind the little wood on the left, and the other behind the redoubt 4.

If the village to be fortified were quite isolated, if it had no assistance to look for from any side, and might be attacked on

all points of its circumference, the réduit would have to occupy the interior of the village.

The two examples we have explained embrace almost all cases, and demonstrate the principal conditions which the defence of villages must fulfil in the present state of the art of war.

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